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SEPT. 1937

# ASTOUNDING

## STORIES

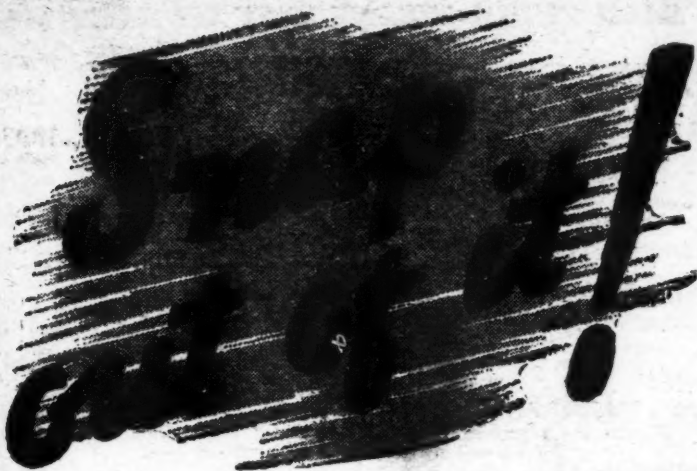


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ATROL

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● THE question is, are you over the depression? Tough? You bet it was—it was the toughest depression this country ever had. But listen: *The future is the brightest that ever beckoned a man.* Opportunity calls from every side—calls to ambitious and trained men! If you have the ambition, the International Correspondence Schools can supply the training. Get going! Snap out of it! Hurry this coupon along to Scranton.

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Title Registered U. S. Patent Office

Volume XX

Number 1

September, 1937

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- GALACTIC PATROL (Part 1) . . . . . E. E. Smith, Ph.D. 8  
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## Novel:

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—and moonshine had two uses—  
GRAVITY, UNAFFECTED . . . . . Stanton A. Coblenz 50  
If fire has its noninflammables—electricity its insulators—then gravity—?  
AIR SPACE . . . . . K. Raymond 97  
The great brain let him see what we could not—that air is actually space itself.  
THE ISOLINGUALS . . . . . L. Sprague de Camp 108  
More than one scientist has been caught—because of theory!

## Science Features:

- BLUFF . . . . . John W. Campbell, Jr. 90  
The sixteenth in the series of scientific discussions which embrace the entire solar system.  
SUPER-FAST EYES . . . . . Thomas Calvert McClary 122  
A science article.

## Readers' Department:

- EDITOR'S PAGE . . . . . 131  
SCIENCE DISCUSSIONS . . . . . 155  
(The Open House of Scientific Controversy)  
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MY RAISE DIDN'T COME THROUGH  
HARRY—MIGHT AS WELL GIVE UP.  
IT ALL LOOKS SO HOPELESS.

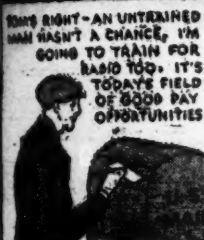


IT ISN'T HOPELESS EITHER  
BILL. WHY DON'T YOU  
TRY A NEW FIELD  
LIKE RADIO?



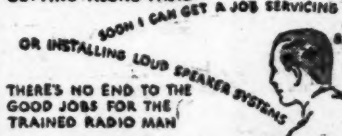
TOM GREEN WENT  
INTO RADIO AND HE'S  
MAKING GOOD MONEY.  
TOO, I'LL SEE HIM  
RIGHT AWAY.

BILL, JUST MAILING THAT  
COUPON GAVE ME A QUICK  
START TO SUCCESS IN RADIO.  
MAIL THIS ONE TONIGHT



THAT'S RIGHT—AN UNTRAINED  
MAN HASN'T A CHANCE, I'M  
GOING TO TRAIN FOR  
RADIO TOO. IT'S  
TODAY'S FIELD  
OF GOOD PAY  
OPPORTUNITIES

TRAINING FOR RADIO IS EASY AND I'M  
GETTING ALONG FAST—



SOON I CAN GET A JOB SERVICING SETS—  
OR IN A BROADCASTING  
STATION  
THERE'S NO END TO THE  
GOOD JOBS FOR THE  
TRAINED RADIO MAN

YOU SURE KNOW  
RADIO—MY SET  
NEVER SOUNDED  
BETTER

THAT'S BECAUSE I'VE  
MADE THIS WEEK  
IN SPARE TIME



N.B. TRAINING CERTAINLY PAYS.  
OUR MONEY WORRIES ARE  
OVER AND WE'VE A BRIGHT  
FUTURE AHEAD IN RADIO.  
MY BILL, IT'S WONDERFUL  
I'VE GONE AHEAD  
SO FAST IN RADIO.

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and am now chief en-  
gineer with WJLY.  
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week to \$25 a week."  
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# Galactic Patrol

PART ONE

by E. E. Smith, Ph.D.

**D**OMINATING twice a hundred square miles of campus, parade ground, airport, and space port, a ninety-story edifice of chromium and glass sparkled dazzlingly in the bright sunlight of a June morning. This monumental pile was Wentworth Hall, in which the Tellurian candidates for the Lens of the Galactic Patrol live and move and have their being. One wing of its topmost floor seethed with tense activity, for that wing was the habitat of the lordly five-year men, this was graduation day, and in a few minutes Class 5 was due to report in Room A.

Room A, the private office of the commandant himself; the dreadful lair into which an undergraduate was summoned only to disappear from the Hall and from the cadet corps; the portentous chamber into which each year the handful of graduates marched and from which they emerged, each man in some subtle fashion changed.

In their cubicles of steel the graduates scanned each other narrowly, making sure that no wrinkle or speck of dust marred the black-and-silver perfection of the dress uniform of the patrol; that not even the tiniest spot of tarnish or dullness violated the glittering golden meteors upon their collars or the resplendently polished ray pistols and other equipment at their belts. The microscopic mutual inspection over, the kit boxes were snapped shut and racked, and the embryonic Lensmen made their way out into the assembly hall.

In the wardroom Kimball Kinnison, captain of the class by virtue of graduat-

ing at its head, and his three lieutenants, Clifford Maitland, Raoul LaForge, and Widel Holmberg, had inspected each other minutely and were now simply awaiting, in ever-increasing tension, the zero minute.

"Now, fellows, remember that drop!" the young captain jerked out. "We're dropping the shaft free, at higher velocity and in tighter formation than any class ever tried before. If anybody hashes the formation—our last show and with the whole corps looking on——"

"Don't worry about the drop, Kim," advised Maitland. "All three platoons will take that like clockwork. What's got me all of a dither is what is really going to happen in Room A."

"Uh-huh!" exclaimed LaForge and Holmberg as one.

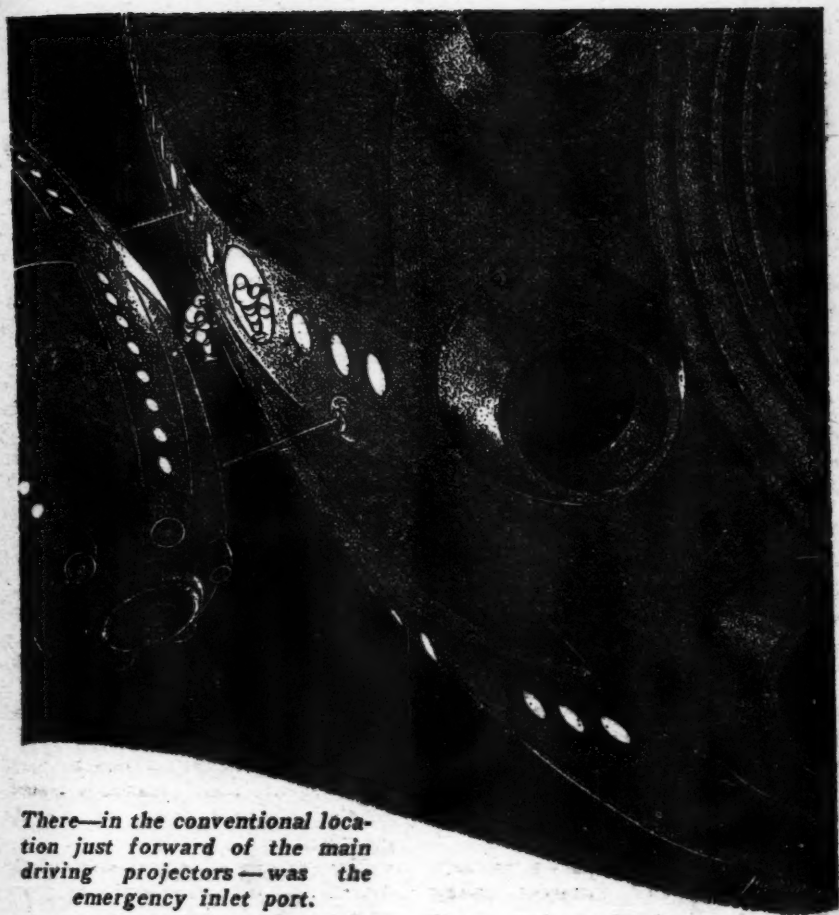
"You can play that across the board for the whole class," Kinnison agreed. "Well, we'll soon know. It's time to get going."

The four officers stepped out into the assembly hall, the class springing to attention at their approach.

Kinnison, now all brisk captain, stared along the mathematically exact lines and snapped: "Report!"

"Class 5 present in full, sir!" The sergeant major touched a stud at his belt and all vast Wentworth Hall fairly trembled under the impact of an all-pervading, lilting, throbbing melody as the world's finest military band crashed into "Our Patrol."

"Squads left—march!" Although no possible human voice could have been heard in that gale of soul-stirring sound, and although Kinnison's lips did not



*There—in the conventional location just forward of the main driving projectors—was the emergency inlet port.*

move, his command was carried to the very bones of those for whom it was intended—and to no one else—by the tight-beam ultra-communicators strapped upon their chests. "Close formation—forward—march!"

IN PERFECT ALIGNMENT and cadence, the little column marched down the hall. In their path yawned the shaft—a vertical pit some twenty feet square extending from main floor to roof of the Hall; more than a thousand sheer feet of unobstructed air,

cleared now of all traffic by flaring red lights. Five left heels clicked sharply, simultaneously upon the lip of the stupendous abyss. Five right legs swept out into emptiness. Five right hands snapped to belts and five bodies, rigidly erect, arrowed downward at such an appalling velocity that to unpracticed vision they simply vanished.

Six tenths of a second later, precisely upon a beat of the stirring march, those ten heels struck the main floor of Wentworth Hall, but not with a click. Dropping with a velocity of almost two thou-



sand feet per second though they were at the instant of impact, yet those five husky bodies came from full speed to an instantaneous, shockless, effortless halt at contact. The drop had been made under complete neutralization of inertia—"free," in space parlance. Inertia restored, the march was resumed—or rather continued—in perfect time with the band. Five left feet swung out, and as the right toes left the floor the second rank, with only bare inches to spare, plunged down into the space its predecessor had occupied a moment before.

Rank after rank landed and marched away with machinelike precision. The dread door of Room A opened automatically at the approach of the cadets and closed behind them.

"Column right—march!" Kinnison commanded inaudibly, and the class obeyed in clockwork perfection. "Column left—march! Squads right—march! Company—halt! Salute!"

In company front, in a huge, square room devoid of furniture, the class faced the ogre—Inspector General Fritz von Hohendorff, commandant of cadets. Martinet, tyrant, dictator—he was known throughout the system as the embodiment of soullessness; and, insofar as he had ever been known to show emotion or feeling before any undergraduate, he seemed to glory in his repute of being the most pitilessly rigid disciplinarian that Earth had ever known. His thick, white hair was roached fiercely upward into a stiff pompadour. His left eye was of glass and his face bore dozens of tiny, threadlike scars; for not even the marvelous plastic surgery of that age could repair entirely the havoc wrought by the lethal rays of space combat. Also, his right leg and left arm, although practically normal to all outward seeming, were in reality largely products of science and art instead of nature.

Kinnison faced, then, this reconstructed potentate, saluted crisply, and

snapped: "Sir, Class 5 reports to the commandant."

"Take your post, sir." The veteran saluted as punctiliously; and as he did so a semicircular desk rose around him from the floor—a desk whose most striking feature was an intricate mechanism surrounding a splintlike form so shaped as to receive a man's left arm.

"No. 1, Kimball Kinnison!" Von Hohendorff barked. "Front and center—march! The oath, sir."

"Before the omnipotent witness I promise never to lower the standard of the Galactic Patrol," Kinnison said reverently; and, baring his left arm, thrust it into the hollow form.

FROM a small container labeled: "No. 1, Kimball Kinnison," the commandant shook out what was apparently an ornament—a lenticular jewel fabricated of hundreds of tiny, dead-white gems. Taking it up with a pair of insulated forceps, he touched it momentarily to the bronzed skin of the arm before him, and at that fleeting contact a flash as of many-colored fire swept over the stones. Satisfied, he dropped the jewel into a recess provided for it in the mechanism, which at once burst into activity.

The forearm was wrapped in thick insulation; molds and shields snapped into place, and there flared out an instantly suppressed flash of brilliance intolerable. Then the molds fell apart; the insulation was removed; there was revealed the Lens. Clamped to Kinnison's brawny wrist by a massive bracelet of imperishable, almost unbreakable, metal in which it was embedded it shone in all its lambent splendor—no longer a whitely inert piece of jewelry, but a lenticular polychrome of writhing, almost fluid radiance, which proclaimed to all observers in symbols of ever-changing flame that here was a Lensman of the Galactic Patrol.



In similar fashion each man of the class was invested with the symbol of his rank. Then the stern-faced inspector general touched a button and from the bare metal floor there arose deeply upholstered chairs, one for each graduate.

"Fall out!" he commanded, then smiled almost boyishly—the first intimation any of the class had ever had that the hard-boiled old tyrant *could* smile—and went on in a strangely altered voice: "Sit down, men, and smoke up. We have an hour in which to talk things over, and now I can tell you what it is all about. Each of you will find his favorite refreshment in the arm of his chair.

"No, there's no catch to it," he continued, in answer to amazedly doubtful stares, and lighted a huge black cigar of Venus-grown tobacco as he spoke. "You are Lensmen now, and henceforth each of you is accountable only to himself and to GHQ. Of course, you have yet to go through the formalities of commencement, but they don't count. Each of you really graduated when the Lens was welded around his arm.

"We know your individual preferences, and each of you has his favorite weed, from Tillotson's Pittsburgh stogies up to Snowden's Alsakanite cigarettes—even though Alsakan is just about as far away from here as a planet can be and still lie within the galaxy.

"We also know that you are all immune to the lure of noxious drugs. If you were not, you would not be here today. So smoke up and speak up. Ask any questions you care to, and I will try to answer them. Nothing is barred now. This room is shielded against any spy-ray or communicator beam operable upon any known frequency."

There was a brief and rather uncomfortable silence. Then Kinnison suggested, diffidently: "Might it not be best, sir, to tell us all about it, from the ground up? I imagine that most of

us are in too much of a daze to ask intelligent questions."

"PERHAPS. While some of you undoubtedly have your suspicions, I will begin by telling you what is behind what you have been put through during the last five years. Feel perfectly free to break in with questions at any time. You know that every year one million eighteen-year-old boys of Earth are chosen as cadets by competitive examinations. You know that during the first year, before any of them see Wentworth Hall, that number shrinks to less than fifty thousand. You know that by graduation day there are only, approximately, one hundred left in the class. Now I am allowed to tell you that you graduates are those who have come with flying colors through the most brutally rigid, the most fiendishly thorough process of elimination that it has been possible to develop.

"Every man who can be made to reveal any sign of weakness is dropped. Most of these are dismissed from the patrol. There are many splendid men, however, who, for some reason not involving moral turpitude, are not quite what a Lensman must be. These men make up our organization, from grease monkeys up to the highest commissioned officers below the rank of Lensman. This explains what you already know—that the Galactic Patrol is the finest body of intelligent beings yet to serve under one banner.

"Of the million who started, you few are left. As must every being who has ever worn or who ever will wear the Lens, each of you has proven repeatedly, to the cold verge of death itself, that he is in every possible respect worthy to wear it. For instance, Kinnison here once had a highly adventurous interview with a lady of Aldebaran II and her friends. He did not know that we knew all about it, but we did."

Kinnison's very ears burned scarlet,

but the commandant went imperturbably on: "So it was with Voelker and the hypnotist of Karalon; with LaForge and the bentlam eaters; with Flewelling when the Ganymede-Venus thionite smugglers tried to bribe him with ten million in gold."

"Good Heavens, commandant!" broke in one outraged youth. "Didn't we do any real work at all?"

"Plenty of it; but at the same time each of you underwent enough testing to prove definitely that you could not be cracked. And none of you need be ashamed, for you have passed every test. Those who did not pass them were those who were dropped.

"Nor is it any disgrace to have been dismissed from the service before graduation into the patrol. The million who started with you were the pick of the planet, yet we knew in advance that of that selected million scarcely one in ten thousand would measure up in every essential. Therefore, it would be manifestly unfair to stigmatize the rest of them because they were not born with that extra something, that ultimate quality of fiber which does, and of stern necessity *must*, characterize the wearers of the Lens. For that reason not even the man himself knows why he was dismissed, and no one save those who wear the Lens knows why they were selected—and a member of the patrol does not talk.

"It is necessary to consider the history and background of the patrol in order to bring out clearly the necessity for such care in the selection of its personnel. You are all familiar with it, but probably very few of you have thought of it in that connection. The patrol is, of course, an outgrowth of the old planetary police systems; and, until its development, law enforcement always lagged behind law violation. Thus, in the old days following the invention of the automobile, State troopers could not cross State lines. Then, when the

national police finally took charge, they could not follow the rocket-equipped criminals across national boundaries.

"STILL LATER, when interplanetary flight became a commonplace, the planetary police were at the same old disadvantage. They had no authority off their own worlds, while the public enemies flitted unhampered from planet to planet. And finally, with the invention of the inertialess drive and the consequent traffic between the worlds of hundreds of thousands of solar systems, crime became so rampant, so utterly uncontrollable, that it threatened the very foundations of civilization. A man could perpetrate any crime imaginable without fear of consequences, for in an hour he could be thousands of light years away from the scene and safely beyond the reach of the law.

"And helping powerfully toward utter chaos were the new vices, which were spreading from world to world; among others the taking of new and horrible drugs. Thionite, for instance; occurring only upon Trengo; a drug as much deadlier than heroin as that compound is than coffee, and which even now commands such a fabulous price that a man can carry a fortune in one hollow boot heel.

"Thus our patrol came into being. At first it was a pitiful enough organization. It was handicapped from without by politics and politicians, and at the same time it was honeycombed from within by the usual small but utterly poisonous percentage of the unfit—grafters, corruptionists, bribe takers, and out-and-out criminals. It was also hampered by the fact that there was then no emblem or credential which could not be counterfeited. No one could tell with certainty that the man in uniform was a patrolman and not a criminal in disguise.

"Slowly the patrol perfected itself. One of its greatest advances came with

the invention of the Lens; which, being proof against counterfeiting or imitation, renders identification of all Lensmen automatic. The patrol then set up its own military courts and executed the few of its members guilty of misconduct. Standards of entrance were raised ever higher, and when it had become evident that the patrol was, to a man, incorruptible, it was granted more and ever more authority.

"Now its power is practically absolute. Its armament and equipment are the ultimate; its members can follow the lawbreaker wherever he may go. Furthermore, a Lensman can commandeer any material or assistance, wherever and whenever required; and the Lens is so respected throughout the galaxy that any wearer of it may be called upon at any time to be judge, jury, and executioner. Wherever he goes, upon, in, or through any land, water, air, or space, anywhere within the confines of our Island Universe, his word is *law*.

"That, I think, explains what you have been forced to undergo. The only excuse for its severity is that it produces results. In the last hundred years no wearer of the Lens has disgraced it. Any questions? About the Lens, for instance?"

"We have all wondered about the Lens, sir, of course," Maitland ventured. "The outlaws apparently keep up with us in science. Boskone himself is supposed to be a genius, and to have surrounded himself with a scientific staff second to none in the known universe. I have always supposed that what science can build, science can duplicate. Surely more than one Lens has fallen into the hands of the outlaws?"

"If it had been a scientific invention it would have been duplicated long ago," the commandant made surprising answer. "It is, however, not essentially scientific in nature. It is almost entirely philosophical, and was developed for us by the Arisians.

"Yes, each of you was sent to Arisia quite recently," Von Hohendorff went on, as the newly commissioned officers glanced at each other in dawning understanding. "What did you think of them, Murphy?"

"At first, sir, I thought that they were some new kind of dragon; but dragons with brains that you could actually *feel*. I was glad to get away, sir. They fairly gave me the creeps, even though I never did see one of them so much as move."

"THEY ARE a peculiar race," the commandant went on. "Essentially anti-social—or rather, supremely indifferent to all material things. For hundreds of thousands of generations they have devoted themselves to thinking; mainly of the essence of life. They say that they know scarcely anything fundamental concerning it; but even so they know more about it than does any other known race. While ordinarily they will have no intercourse whatever with outsiders, they did consent to help the patrol, for the good of all intelligence.

"Thus, each being about to graduate into the patrol is sent to Arisia, where a Lens is built to match its individual life force. While no mind other than that of an Arisian can understand its operation, thinking of your Lens as being synchronized with, or in exact resonance with your own vital principle or ego will give you a rough idea of it. The Lens is not really alive, as we understand the term. It is, however, endowed with a sort of pseudolife, by virtue of which it gives off its strong, characteristically changing light as long as it is in metal-to-flesh circuit with the living mentality for which it was designed. Also, by virtue of that pseudolife, it acts as a telepath through which you may converse with other intelligences, even though they may possess no organs either of sight or of hearing as we know those senses. It also has other highly important uses.

"The Lens cannot be removed by any one except its wearer without dismemberment; it glows as long as its rightful owner wears it; and it ceases to glow in the instant of its owner's death. Also—and here is the thing that renders impossible the impersonation of a Lensman—not only does the Lens not glow if worn by an impostor; but if a patrolman be dismembered and his Lens removed, that Lens kills, in a space of minutes, any living being who attempts to wear it. Its pseudolife interferes so strongly with any life to which it is not attuned that that life force cannot exist in this plane."

A BRIEF SILENCE fell, during which the young men absorbed the stunning import of what their commandant had been saying. More, there was striking into each young consciousness a realization of the stark heroism of the grand old Lensman before them; a man of such fiber that although physically incapacitated and long past the retirement age, he had conquered his human emotions sufficiently to accept deliberately his ogre's rôle, because in that way he could best further the progress of his patrol!

"I have scarcely broken the ground," Von Hohendorff continued. "I have merely given you an introduction to your new status. During the next few weeks, before you are assigned to duty, other officers will make clear to you the many things about which you are still in the dark. Our time is growing short, but perhaps we have time for one more question."

"Not a question, sir, but something more important," Kinnison spoke up. "I speak for the class when I say that we have misjudged you grievously, and we wish to apologize."

"I thank you sincerely for the thought, although it is unnecessary. You could not have thought otherwise of me than as you did. It is not a par-

ticularly pleasant task that we old men have—that of weeding out the unfit. But we are too old for active duty in space—we no longer have the instantaneous nervous responses that are for that duty imperative—so we do what we can. However, the work has its brighter side, since each year there are about a hundred found worthy of the Lens. This, my one hour with the graduates, more than makes up for the year that precedes it; and the other oldsters have somewhat similar compensations.

"In conclusion, you are now able to understand fully what kind of mentalities compose our patrol. You know that any creature wearing the Lens is in every sense a Lensman, whether he be human or, hailing from some strange and distant planet, a monstrosity of a shape you have as yet not even imagined. Whatever his form, you may rest assured that he has been tested even as you have been; that he is as worthy of trust as are you yourselves. My last word is this—men of the Galactic Patrol die, but they do not fold up; individuals come and go, but the patrol goes on!"

Then, again all martinet: "Class 5, attention!" he barked. "Report upon the stage of the main auditorium!"

The class, again a rigidly military unit, marched out of Room A and down the long corridor toward the great theater in which, before the massed cadet corps and a throng of civilians, they were to be formally graduated.

As they marched along the graduates realized in what way the wearers of the Lens who emerged from Room A were different from the candidates who had entered it such a short time before. They had gone in as boys—nervous, apprehensive, and still somewhat unsure of themselves, in spite of their survival through the five long years of grueling tests which now lay behind them. They emerged from Room A as men; men knowing for the first time the real mean-



ing of the physical and mental tortures they had undergone; men able to wield justly the vast powers whose scope and scale they could even now but dimly comprehend.

## II.

BARELY A MONTH after his graduation, even before he had entirely completed the postgraduate tours of duty mentioned by Von Hohendorf; Kinnison was summoned to Prime Base by no less a personage than Port Admiral Haynes himself. There, in the admiral's private *aéro*, whose flaring lights cleared a path as though by magic through the swarming traffic, the novice and the veteran flew slowly over the vast establishment of the base.

Shops and factories, citylike barracks, landing fields stretching beyond the far horizon; flying craft ranging from tiny, one-man helicopters through small and large scouts, patrol ships and cruisers up to the immense, globular superdreadnaughts of space—all these were observed and commented upon. Finally, the *aéro* landed beside a long, comparatively low building—a structure heavily guarded, inside the base although it was—within which Kinnison saw a thing that fairly snatched away his breath.

A space ship it was—but what a ship! In bulk it was vastly larger even than the superdreadnaughts of the patrol; but, unlike them, it was, in shape, a perfect teardrop, streamlined to the ultimate possible degree.\*

"What do you think of her?" the port admiral asked.

\* In the "big teardrops"—cruisers and battleships—the driving force is always directed upward, along the geometrical axis of the ship, and the artificial gravity is always downward along that same line. Thus, throughout any possible maneuvering, free or inert, "down" and "up" have the same significance as within any Earthly structure.

These vessels are ordinarily landed only in special docks, but in emergencies can be landed almost anywhere, sharp stern down, as their immense weight drives them deep enough into even the hardest ground to keep them upright. They sink in water, but are readily maneuverable, even under water.

"Think of her!" The young officer gulped twice before he attained coherence. "I can't put it in words, sir; but some day, if I live long enough and develop enough force, I hope to command a ship like that."

"Sooner than you think, Kinnison," Haynes told him, flatly. "You are in command of her beginning to-morrow morning."

"Huh? Me?" Kinnison exclaimed, but sobered quickly. "Oh, I see, sir. It takes ten years of proved accomplishment to rate command of a first-class enforcement vessel, and I have no rating at all. You have already intimated that this ship is experimental. There is, then, something about her that is new and untried, and so dangerous that you do not want to risk an experienced commander in her. I am to give her a work-out, and if I can bring her back in one piece I turn her over to her real captain. But that's all right with me, admiral—thanks a lot for picking me out. What a chance! *What* a chance!" Kinnison's eye gleamed at the prospect of even a brief command of such a creation.

"Right—and wrong," the old admiral made surprising answer. "It is true that she is new, untried, and dangerous, so much so that we are unwilling to give her to any of our present captains. No, she is not really new, either. Rather, her basic idea is so old that it has been abandoned for centuries. She uses explosives, of a type that cannot be tried out fully except in actual combat. Her primary weapon is what we have called the 'Q-gun.' The propellant is heptadetonite; the shell carries a charge of twenty metric tons of duodecaplylato-mate."

"But, sir—" Kinnison began.

"JUST A MINUTE, I'll go into that later. While your premises were correct, your conclusion is not. You graduated No. 1, and in every respect,



save experience, you are as well qualified to command as is any captain of the fleet; and since the *Brittania* is such a radical departure from any conventional type, battle experience is not a prerequisite. Therefore, if she holds together through one engagement she is yours for good. In other words, to make up for the possibility of having yourself scattered all over space, you have a chance to win that ten years' rating you mentioned a minute ago, all in one trip. Fair enough?"

"Fair? It's fine—wonderful! And thanks a——"

"Never mind the thanks until you get back. You were about to comment, I believe, upon the impossibility of using explosives against a free opponent?"

"It can't be impossible, of course, since the *Brittania* has been built. I just don't quite see how it could have been made effective."

"You lock to the pirate with tractors, screen to screen—dex about ten kilometers. You blast a hole through his screens to his wall shield. The muzzle of the Q-gun mounts an annular multiplex projector which puts out a Q-type tube of force—Q47SM9, to be exact. As you can see from the type formula, this helix extends the gun barrel from ship to ship and confines the propellant gases behind the projectile, where they belong. When the shell strikes the wall shield of the pirate and detonates, *something* will have to give way."

"The tube and tractors, being pure force and computed for this particular combination of explosions, will hold; and our physicists have calculated that the ten-kilometer column of inert propellant gases will offer so much inertia and resistance that any possible wall shield will have to go down. That is the point that cannot be tried out experimentally. It is quite within the bounds of possibility that the pirates may have been able to develop wall screens as powerful as our Q-type helices."

"It should not be necessary to point out to you that if they *have* been able to develop a wall shield that will stand up under detonating duodecaplylato-mate, the back blast through the breech of the Q-gun will blow the *Brittania* apart as though she were made of matchwood. That is only one of the chances—and perhaps not the greatest one—that you and your crew will have to take. They are all volunteers, by the way, and will get plenty of extra rating if they come through alive. Do you want the job?"

"You don't have to ask me that, chief—you *know* I want it!"

"Of course, but I had to go through the formality of asking, sometime. But to get on with the discussion. This pirate situation is entirely out of control, as you already know. We don't even know whether Boskone is a reality, a figurehead, a symbol, or simply a figment of somebody's imagination. But whoever or whatever Boskone really is, some being or some group of beings has perfected a mighty efficient organization of outlaws; so efficient that we haven't been able to locate their main base."

"YOU may as well know now a fact that is not yet public property; that even convoyed vessels are no longer safe. The pirates have developed ships of a new and extraordinary type; ships that are much faster than our heavy battleships, and yet vastly more heavily armed than our fast cruisers. Thus, they can outfight any enforcement vessel that can catch them, and can outrun anything of ours armed heavily enough to stand up against their beams."

"That accounts for the recent heavy losses," Kinnison mused.

"Yes," Haynes went on, grimly. "Ship after ship of our best has been blasted out of the ether, doomed before it pointed a beam, and more will be. We cannot force an engagement on our terms; we must fight on theirs."

"That is the present intolerable situation. We *must* learn what the pirates' new power system is. Our scientists say that it may be anything, from cosmic-energy receptors and converters down to a controlled space warp—whatever that may be. Anyway, they haven't been able to duplicate it, so it is up to us to find out what it is. The *Brittania* is the tool our engineers have designed to get that information. She is the fastest thing in space, developing at full blast an inert acceleration of *ten gravities*. Figure out for yourself what velocity that means free in open space!"

"You have just said that we can't have everything in one ship," Kinnison said, thoughtfully. "What did they sacrifice to get that speed?"

"All the conventional offensive armament," Haynes replied frankly. "She has no long-range beams at all, and only enough short-range stuff to help drive the Q-helix through the enemy's screens. Practically her only offense is the Q-gun. But she has plenty of defensive screens; she has speed enough to catch anything afloat; and she has the Q-gun—which we hope will be enough.

"Now we'll go over the general plan of action. The engineers will go into all the technical details with you, during a test flight that will last as long as you like. When you and your crew are thoroughly familiar with every phase of her operation, bring the engineers back here to base and go out on patrol.

"Somewhere in the galaxy you will find a pirate vessel of the new type. You lock to him, as I said before. You attach the Q-gun well forward, being sure that the point of attachment is far enough away from the power rooms so that the essential mechanisms will not be destroyed. You board and storm—another revival of the technique of older times. Specialists in your crew, who will have done nothing much up to that time, will then find out what our scientists want to know. If at all

possible, they will send it in instantly via tight-beam communicator. If, because of distance or for any other reason, it should be impossible for them to communicate, the whole thing is again up to you."

The port admiral paused, his eyes boring into those of the younger man, then went on impressively: "That information *must* get back to base. If it does not, the *Brittania* is a failure; we will be right back where we started from; the slaughter of our men and the destruction of our ships will continue unchecked. As to how you are to do it, we cannot give you even general instructions. All I can say is that you have the most important assignment in the universe to-day, and repeat—that *information must get back to base*. Now come aboard and meet your crew and the engineers."

UNDER the expert tutelage of the designers and builders of the *Brittania* Vice Commander Kinnison drove her hither and thither through the trackless wastes of the galaxy\* Inert and "free," under every possible degree of power he maneuvered her; attacking imaginary foes and actual meteorites with equal zeal. Maneuvered and attacked until he and his ship were one; until he reacted automatically to her slightest demand; until he and every

\*Navigation. Each ship has a reference sphere held rigidly by gyroscopes so that its great circle of galactic longitude is always parallel to the galactic equator. Its line of zeros is always parallel to the line joining Centralia, the central solar system of the galaxy, with the system of Vandemar, which is on its very rim. Thus, courses are expressed in galactic longitude and latitude, from 0 to 360 degrees in each circle.

Position is expressed in galactic coordinates of "x," "y" and "z." The origin is at Centralia, and the line of positive "x" is the above-mentioned Centralia-Vandemar line.

The position of the ship in the galaxy is known at all times by that of a moving dot in the tank. This dot is shifted automatically by calculating machines coupled inductively to the leads of the drives. When the ship is inert this device is inoperative, as any distance traversed in inert flight is entirely negligible in galactic computations. Due to various perturbations and other slight errors, cumulative discrepancies occur, for which the pilot must from time to time correct manually the position of the dot in the tank representing his ship.



*Slowly the giant projectile crept along—watched in awe and amazement by the officers of both vessels.*



*Far to those space-hardened veterans the velocity of light was a veritable crawl—and here was a thing that would require four or five whole seconds.*



man of his eager and highly trained crew knew to the final volt and to the ultimate amperage her Gargantuan capacity both to give it and to take it.

Then and only then did he return to base, unload the engineers, and set out upon the quest. Trail after trail he followed, but all were cold. Alarm after alarm he answered, but always he arrived too late; arrived to find gutted merchantmen and riddled enforcement vessel, with no life in either and with nothing to indicate in which direction the marauders might have gone.

Finally, however: "QBT! Calling QBT!" The *Brittania's* code call blared from the sealed-band speaker, and a string of numbers followed—the spatial coordinates of the luckless vessel's position.

Chief Pilot Henry Henderson punched the figures upon his locator, and in the "tank"—the enormous, minutely cubed model of the galaxy—there appeared a redly brilliant point of light. Kinnison rocketed out of his narrow bunk, digging the sleep out of his eyes, and shot himself into his place beside the pilot.

"Right in our laps!" he exulted. "Scarcely ten light years away! Start scrambling the ether!" And as the vengeful cruiser darted toward the scene of depredation all space became filled with blast after blast of static interference through which, it was hoped, the pirate could not summon the help he was so soon to need.

But that howling static gave the pirate commander pause. Surely this was something new? Before him lay a richly laden freighter, its two convoying enforcement ships already practically *hors de combat*. A few more minutes and the prize would be his. Nevertheless, he darted away, swept the ether with his detectors, saw the *Brittania*, and turned in headlong flight. For if this streamlined freighter was sufficiently convinced of its prowess to try

to blanket the ether against him, that information was something that Boskone would value far above one shipload of material wealth.

BUT the pirate craft was now upon the visiplates of the *Brittania*, and, entirely ignoring the crippled space ships, Henderson flung his vessel after the other. Manipulating his incredibly complex controls purely by touch, the while staring into his plate not only with his eyes, but with every fiber of his being as well, he hurled his huge mount hither and thither in frantic leaps. After what seemed an age he snapped down a toggle switch and relaxed long enough to grin at Kinnison.

"Holding 'em?" the young commander demanded.

"Got 'em, skipper," the pilot replied, positively. "It was touch and go for ninety seconds, but I've got a CRX tracer on him now at full pull. He can't put out enough jets to get away from *that*. I can hold him forever!"

"Fine work, Hen!" Kinnison strapped himself into his seat and donned his headset. "General call! Attention! Battle stations! By stations, report!"

"Station 1, tractor beams—hot!"

"Station 2, repellers—hot!"

"Station 3, projector 1—hot!"

Thus station after station of the warship of the void reported, until: "Station 58, the Q-gun—hot!" Kinnison himself reported; then gave to the pilot the words which throughout the spaceways of the galaxy had come to mean complete readiness to face any emergency.

"Hot and tight, Hen—let's take 'em!"

The pilot shoved his blast lever, already almost at maximum, clear out against its stop and hunched himself even more intently over his instruments. As moved his pointers, so varied the direction of the thrust that was driv-



ing the *Brittania* toward the enemy at the unimaginable velocity of ninety parsecs an hour\*—a velocity possible only to inertialess matter being urged through an almost perfect vacuum by a driving blast capable of lifting the stupendous normal tonnage of the immense sky rover against a gravity ten times that of her native Earth.

Unimaginable? Completely so—the ship of the Galactic Patrol was hurling herself through space at a pace in comparison with which any speed that the mind can grasp would be the merest crawl: a pace to make light itself seem stationary.

Ordinary vision would have been useless, but the observers of that day used no antiquated optical system. Their detector beams, converted into light only at their plates, were heterodyned upon and were carried by subetheral ultra-waves; vibrations residing far below the level of the ether and thus possessing a velocity and a range infinitely greater than those of any possible ether-borne wave.

Although stars moved across the visiplates in flaming, zigzag lines of light, as pursued and pursuer passed system after solar system in fantastic, light-years long hops, yet Henderson kept his cruiser upon the pirate's tail and steadily cut down the distance between them. Soon a tractor beam licked out from the patrol ship, touched the fleeing marauder lightly, and the two space ships flashed toward each other.

\* With the neutralization of inertia it was discovered that while inert mass is limited to the velocity of light, there is no limit whatever to the velocity of inertialess matter. A "free" ship takes on instantly the velocity at which the force of her drive is exactly equalled by the friction of the medium. This velocity is determined by many factors; but, assuming an ultrafast shape, a standard mass-to-volume ratio, a power to develop an inert acceleration of ten Earth gravities, and a density of matter in space of one atom per ten cubic centimeters, such speeds are not at all unusual.

It may be of interest to note here that Mays and Cornell recently made the transgalactic run along the line of zeros, from Alaskan past Centrastra to Vandemar, a distance of 100,308,460 parsecs, in 1253,486 hours (Galactic Standard); thus establishing a new galactic record of 80,1244 parsecs per hour for the entire distance.

NOR was the enemy unprepared for combat. One of the crack raiders of Boskone, master pirate of the known universe, she had never before found difficulty in conquering any vessel fleet enough to catch her. Therefore, her commander made no attempt to cut the beam. Or rather, since the two inertialess vessels flashed together to repeller-zone contact in such a minute fraction of a second that any human action within that time was impossible, it would be more correct to say that the pirate captain changed his tactics instantly from those of flight to those of combat.

He thrust out tractor beams of his own, and from the already white-hot refractory throats of his projectors there raved out horribly potent beams of annihilation, beams of dreadful power which tore madly at the straining defensive screens of the patrol ship. Screens flared vividly, radiating all the colors of the spectrum. Space itself seemed a rainbow gone mad, for there were being exerted there forces of a magnitude to stagger the imagination—forces to be yielded only by the atomic might from which they sprang—forces whose neutralization set up visible strains in the very fabric of the ether itself.

The young commander, seated at his conning plate, clenched his fists and swore a startled, deep-space oath as his eyes swept over the delicately accurate meters and gauges before him; for under the frightful impact of that instantaneously launched attack his outer screen was already down and his second was beginning to crack!

"We'll have to scrap the regulation battle plan!" he barked into his microphone. "Open all motors to absolute top; cut all resistance out of No. 3 Circuit. Dalhousie, cut all repellers, bring us right up to their zone. All you beamers, concentrate on area K. *Break down those screens!*" Kinnison was hunched rigidly over his panel; his

voice came grittily through locked teeth. "Cut all your resisters if you have to, the motors and accumulators will hold long enough. There, that's better. Our third is up again and theirs is going down. Come on, boys, burn 'em down! Give 'em everything you can put through the bare bus bars! No matter what it takes, get through to that wall shield, so that I can use this Q-gun!"

Little by little, under the stupendous force of the *Brittania's* attack the defenses of the enemy began to fail, and Kinnison's hands flew over his controls. A port opened in the patrol ship's armored side and an ugly snout protruded—the projector-ringed muzzle of a squat and monstrous cannon. From its projector bands there leaped out, with the velocity of light, a tube of quasi-solid force which was, in effect, a continuation of the rifle's grim barrel; a tube which crashed through the weakened third screen of the enemy with a space-racking shock and struck savagely, with writhing, twisting thrusts, at the second.

Aided by the massed concentration of the *Brittania's* every battery of short-range beams, it went through—and through the first. Now it struck the very wall shield of the outlaw—that impregnable screen which, designed to bear the brunt of any possible inert collision, had never been pierced or ruptured by any material substance, however applied.

To this inner defense the immaterial gun barrel clung. Simultaneously, the tractor beams, hitherto exerting only a few dynes of force, stiffened into unbreakable, inflexible rods of energy, binding the two ships of space into one rigid system; each, relative to the other, immovable.

THEN Kinnison's flying finger tip touched a button and the Q-gun spoke. From its sullen throat there erupted a huge torpedo. Slowly the giant pro-

jectile crept along, watched in awe and amazement by the officers of both vessels. For to those space-hardened veterans the velocity of light was a veritable crawl; and here was a thing that would require four or five whole seconds to cover a mere ten kilometers of distance!

But, although slow, this bomb might prove dangerous, therefore the pirate commander threw his every resource into attempts to cut the tube of force, to blast away from the tractor beams, to explode the sluggish missile before it could reach his wall shields. In vain; for the *Brittania's* every beam was set to protect the torpedo and the mighty rods of energy without whose grip the inertialess mass of the enemy vessel would offer no resistance whatever to the force of the proposed explosion.

Slowly, so slowly, as the age-long seconds crawled into eternity, there extended from enforcement vessel almost to pirate wall a raging, white-hot-pillar—the gases of combustion of the propellent heptadetonite—ahead of which there rushed the Q-gun's tremendous shell with its horribly destructive freight. What would happen? Could even the almost immeasurable force of that frightful charge of duodecaplylatomate break down a wall shield designed to withstand the cosmic assaults of meteoric missiles? And what would happen if that wall screen held?

In spite of himself Kinnison's mind insisted upon painting the ghastly picture: the awful explosion; the pirate's screen still intact; the raving gases driven backward along the tube of force. The bare metal of the Q-gun's breech, he knew, was not and could not be reinforced by the infinitely stronger, although immaterial shields of pure energy which protected the hull; and no conceivable substance, however resistant, could impede, save momentarily, the unimaginable forces about to be unleashed.

Nor would there be time to release

the Q-tube after the explosion but before the *Brittania's* own destruction; for if the enemy's shield stayed up for even a fraction of a second, the unthinkable pressure of the blast would propagate backward through the already densely compressed gases in the tube, would sweep away as though it were nothing the immensely thick metallic barrier of the gun breech, and would wreak within the bowels of the patrol ship a destruction even more complete than that intended for the foe.

Nor were his men in better case. Each knew that this was the climactic instant of his whole existence; that life itself hung poised upon the issue of the next split second. Hurry it up! Snap into it! Will that crawling, creeping thing *never* strike? Some prayed briefly; some swore bitterly; but prayers and curses were alike unconscious and had precisely the same meaning—each man, white of face and grim of jaw, clenched his hands and waited, tense and straining, for the impact.

### III.

THE MISSILE STRUCK, and in the instant of its striking the coldly brilliant stars were blotted from sight in a vast globe of intolerable flame. The pirate's shield had failed, and under the cataclysmic force of that horrible detonation the entire nose section of the enemy vessel had flashed into incandescent vapor and had added itself to the rapidly expanding cloud of fire. As it expanded, the cloud cooled. Its fierce glare subsided to a rosy glow, through which the stars again began to shine. It faded, cooled, darkened, revealing the crippled hulk of the pirate ship. She was still fighting; but ineffectually, now that all her heavy forward batteries were gone.

"Needlers, fire at will!" barked Kinnison, and even that feeble resistance was ended. Keen-eyed needle-ray men,

working at spy-ray visiplates, bored hole after hole into the captive, seeking out and destroying the control-panels of the remaining beams and screens.

"Pull 'er up!" came the next order. The two ships of space flashed together—the yawning, blasted-open fore end of the once cigar-shaped raider solidly against the *Brittania's* armored side. A great port opened.

"Now, Bus, it's all yours. Classification to three places—A point A A. They're human or approximately so. Board and storm!"

Back of that port there had been massed a hundred fighting men—dressed in full panoply of space armor, armed with the deadliest weapons known to the science of the age, and powered by the gigantic accumulators of their ship. At their head was Sergeant VanBuskirk, six and a half feet of Dutch-Valerian dynamite, who had fallen out of Valeria's cadet corps only because of an innate inability to master the intricacies of higher mathematics. Now the attackers swept forward in a black-and-silver wave.

Four squatly massive semiportable projectors crashed down upon their magnetic clamps and in the fierce ardor of their beams the thick bulkhead before them ran the gamut of the spectrum and puffed outward. Some score of defenders were revealed, likewise clad in armor, and battle again was joined. Explosive and solid bullets detonated against and ricocheted from that highly efficient armor, the beams of DeLameter hand projectors splashed in torrents of man-made lightning off its protective fields of force.

But that skirmish was soon over. The semiportables, whose vast energies no ordinary personal armor could withstand, were brought up and clamped down; and in their holocaust of vibratory destruction all life vanished from the pirates' compartment.

"One more bulkhead and we're in

their control room!" VanBuskirk cried. "Beam it down!"

But when the beams pressed their switches nothing happened. The pirates had managed to jury rig a screen generator, and with it had cut the power beams behind the invading forces. Also they had cut loopholes in this bulkhead, through which, in frantic haste, they were trying to bring heavy projectors of their own into alignment.

"Bring up the ferral paste," the sergeant commanded. "Get up as close to that wall as you can, so they can't blast us!"

The paste—an ultra-modern development of thermite—was brought up and the giant Dutchman himself troweled it on in furious swings, from floor up and around in a huge arc and back down to floor. He fired it, and simultaneously some of the enemy gunners managed to angle a projector sharply enough to reach the farther ranks of the enforcement men. Then mingled the flashing, scintillating, gassy glare of the thermite and the raving energy of the pirates' beam to make of that confined space a veritable inferno.

BUT the paste had done its work, and as the semicircle of wall fell out the soldiers of the Lens leaped through the hole in the still-glowing wall to struggle hand to hand against the pirates, now making a desperate last stand. The semiportables and other heavy ordnance powered from the *Brittania's* accumulators were, of course, useless. Pistols were ineffective against the pirates' armor of hard alloy; hand rays were equally impotent against its defensive shields.

Now heavy hand grenades began to rain down among the combatants, blowing enforcement men and no few pirates to bits. For the outlaw chiefs cared nothing that they killed some of their own men, if in so doing they could take a proportionately greater toll of the law.

And worse, a crew of gunners was swiveling a mighty projector around upon its hastily improvised mount, to cover that sector of the great compartment in which the policemen were most densely massed.

But the minions of the law had one remaining weapon, carried expressly for this eventuality, and no mean weapon it proved to be. The space ax—a combination and sublimation of battle ax, mace, and bludgeon—a massively needle-pointed implement of potentialities limited only by the physical strength and bodily agility of its wielder.

Now, all the men of the *Brittania's* storming party were Valerians, and therefore were big, hard, fast, and agile; and of them all, their sergeant leader was the biggest, hardest, fastest, and most agile. When the space-tempered apex of that thirty-pound monstrosity, driven by the four-hundred-odd pounds of rawhide and whalebone that was his body, struck pirate armor, that armor gave way. Nor did it matter whether or not that hellish beak of steel struck a vital part after crashing through the armor. Head or body, leg or arm, the net result was the same; a man does not fight effectively when he is breathing space in lieu of atmosphere.

VanBuskirk perceived the danger to his men in the slowly turning ray projector, and for the first time called his chief.

"Kim," he spoke in level tones into his microphone. "Blast that delta ray, will you? . . . Or have they cut this beam, so you can't hear me? . . . Guess they have."

"They've cut our communication," he informed his troopers then. "Keep them off me as much as you can and I'll attend to that delta-ray outfit myself."

Aided by the massed interference of his men, he plunged toward the threatening mechanism, hewing to right and to left as he strode. Beside the temporary projector mount at last, he aimed



a tremendous blow at the man at the delta-ray controls; only to feel the ax flash instantaneously to its mark and strike it with a gentle push, and to see his intended victim float effortlessly away from the blow. The pirate commander had played his last card: VanBuskirk floundered, not only weightless, but inertialess as well!

But the huge Dutchman's mind, while not mathematical, was even faster than his lightninglike muscles, and not for nothing had he spent arduous weeks in inertialess tests of strength and skill. Hooking feet and legs around a convenient wheel, he seized the enemy operator and jammed his helmeted head down between the base of the mount and the long, heavy steel lever by means of which it was turned. Then, throwing every ounce of his wonderful body into the effort, he braced both feet against the projector's grim barrel and heaved. The helmet flew apart like an eggshell; blood and brains gushed out in nauseous blobs. But the delta-ray projector was so jammed that it would not soon again become a threat.

Then VanBuskirk drew himself across the room toward the main control panel of the warship. Officer after officer he pushed aside, then reversed two double-throw switches, restoring gravity and inertia to the riddled cruiser.

IN THE MEANTIME the tide of battle had continued in favor of enforcement. Few survivors though there were of the black-and-silver force, of the pirates there were still fewer, fighting now a desperate and hopeless defensive. But in this combat quarter was not, *could* not be thought of, and Sergeant VanBuskirk again waded into the fray. Four times more his horribly effective hybrid weapon descended like the irresistible hammer of Thor, cleaving and crushing its way through steel and flesh and bone. Then, striding to the control board, he manipulated

switches and dials, then again spoke evenly to Kinnison.

"You can hear me now, can't you? . . . All mopped up. Come and get the dope!"

The specialists, headed by Chief Technician LaVerne Thorndyke, had been waiting strainingly for that word for minutes. Now they literally flew at their tasks, in furious haste, but following rigidly and in perfect coordination a prearranged schedule. Every control and lead, every bus bar and immaterial beam of force was traced and checked. Instruments and machines were dismantled; sealed mechanisms were ruthlessly torn apart by jacks or sliced open with cutting beams. And everywhere, everything and every movement was being photographed, charted, and diagramed.

"Getting the idea now, Kim," the chief technician said finally, during a brief lull in his work. "A sweet system——"

"Look at this!" a mechanic interrupted. "Here's a machine that's all shot to pieces!"

The shielding cover had been torn from a monstrous fabrication of metal, apparently a motor or generator of an exceedingly complex type. The insulation of its coils and windings had fallen away in charred fragments; its copper had melted down in sluggish, viscous streams.

"That's what we've been looking for," Thorndyke declared. "Check those leads! Alpha!"

"Seven-three-nine-four!" And the minutely careful study went on until: "That's enough; we've got everything we need now. Have you draftsmen and photographers got everything down solid?"

"On the boards!" and "In the cans!" rapped out the two reports as one.

"Then let's go!"

"And go fast!" Kinnison ordered,

brusquely. "I'm afraid that we're going to run out of time as it is!"

All hands hurried back into the *Brittania*, paying no attention to the bodies littering the decks. So desperate was the emergency, each man knew, that nothing could be done about the dead, whether friend or foe. Every resource of mechanism, of brain and of brawn, must needs be strained to the utmost if they themselves were not soon to be in similar case.

"Can you talk, Nels?" demanded Kinnison of his communications officer, even before the air lock had closed.

"No, sir. They're blanketing us plenty," that worthy replied instantly. "Space's so full of static that you couldn't drive a power beam through it, let alone a communicator. Couldn't talk direct, anyway. Look where we are." He pointed out in the tank their present location.

"Hm-m-m. We couldn't have got much farther away from Earth without jumping the galaxy entirely. Boskone got a warning, either from that ship back there or from the disturbance. They are undoubtedly concentrating on us now. One of them will spear us with a tractor, just as sure as hell's a man trap—"

THE fledgling commander rammed both hands into his pockets and thought in black intensity. He *must* get this data back to base. But how? *HOW?* Henderson was already driving the vessel back toward the solar system with every iota of her inconceivable top speed, but it was out of the question even to hope that she would ever get there. The life of the *Brittania* was now, he was coldly certain, to be measured in hours—and all too scant measure, even of them. For there were hundreds of pirate vessels tearing through the void, forming a gigantic net to cut off her return to base. Fast though she was, one of that barricading horde

would certainly manage to clamp a tracer ray upon her—and when that happened her flight was done.

Nor could she fight. She had conquered one first-class war vessel of the public enemy, it was true; but at what awful cost her captain knew only too well. The prodigious drain of power had almost emptied her accumulators. Also, and worse, the refractories of her main projectors were burned away practically to the shells. Without vastly heavier bracing fields than the *Brittania* carried, no substance, however stable, could stand up long under such hellish loads as they had had to handle.

The Q-gun was as useless as a fountain pen without full-driven offensive beams. One fresh vessel, similar to the one they had just left, could very easily blast his crippled mount out of space. Nor would there be only one. Within a space of minutes after the attachment of a tracer ray, the enforcement vessel would be surrounded by the cream of Boskone's fighters. There was apparently only one way out offering any chance at all of success; and slowly, thoughtfully, and finally grimly, young Vice Commander Kinnison—now and briefly Captain Kinnison—decided to take it.

"Everybody open your communicators and listen!" he ordered. "We must get this information back to base, and we can't do it in the *Brittania*. The pirates are bound to catch us, and our chance in another fight is exactly zero. We'll have to abandon ship and take to the lifeboats, in the hope that at least one of us will be able to get through their lines.

"The technicians and specialists will take all the data they got—information, descriptions, diagrams, pictures, everything—boil it down, and put it on a spool of tape. They will make thirty-nine copies of it, since there are just forty of us left, and one spool will be given to each man.

"There will be twenty boats, two men to a boat. We will start launching them after we have gone as far toward base as it is safe to go in this ship. Once away, use very little detectable power, or, better yet, no power at all, until you are sure that the pirates have chased the *Brittania* a good many parsecs away from where you are. From then on you'll be strictly on your own. Do it any way you can; but some way, any way, get your spool back to base. There's no use in me trying to impress you with the importance of this stuff; you know what it means as well as I do.

"Boat mates will be drawn by lot. The quartermaster will write all our names on slips of paper and draw them out of a helmet two at a time. The only exception to this is that if two navigators, such as Henderson and I, are drawn together, both names go back into the helmet. Get to work!"

TWICE the name of Kinnison came out together with that of another skilled in astronautics and was replaced. The third time, however, it came out paired with VanBuskirk, to the manifest joy of the giant policeman and to the approval of the crowd as well.

"That was a break for me, chief!" the sergeant called over the cheers of his fellows. "I'm dead sure of getting back now!"

"Pretty strong talk, I'm afraid, but I don't know of any one I'd rather have at my back than you," Kinnison replied, with a boyish grin.

The pairings were made; DeLameters, spare batteries, and other equipment were checked and tested; the spools of tape were sealed in their corrosionproof containers and distributed; and Kinnison sat talking with the chief technician.

"So they've solved the problem of the really efficient reception and conversion of cosmic radiation!" Kinnison whistled softly through his teeth. "And a sun—

even a small one—radiates the energy given off by the annihilation of one-to-several million tons of matter per second! *Some power!*"

"That's the story, skip, and it explains completely why their ships have been so much superior to ours. They could have installed faster drives even than the *Brittania's*. They probably will, now that it has become necessary. Also, if the bus bars in that receptor-converter had been a few square centimeters larger in cross section, they could have held their wall shield, even against our duodec bomb. Then what? They had plenty of intake, but not quite enough distribution."

"They have atomic motors, the same as ours, just as big and just as efficient," Kinnison cogitated. "But those motors are all we *have* got, while they use them, and at full power, too, simply as first-stage exciters for the cosmic-energy screens. Blinding blue blazes, what power! Some of us *have* to get back, Verne. If we don't, Boskone's got the whole galaxy by the tail, and civilization is sunk without a trace."

"I'll say so; but also I'll say this for those of us who don't get back—it won't be for lack of trying. Well, I'd better go check up on my boat. If I don't see you again, Kim old man, clear ether!"

They shook hands briefly and Thorn-dyke strode away. En route, however, he paused beside the quartermaster and signaled to him to disconnect his communicator.

"Clever lad, Allerdyce!" Thorn-dyke whispered, with a grin. "Kinda loaded the dice a trifle once or twice, didn't you? I don't think anybody but me smelled a rat, though. Certainly neither the skipper nor Henderson did, or you'd've had it to do over again."

"At least one team has got to get through," the quartermaster replied, quietly and obliquely, "and the strongest teams we can muster will find the going none too easy. Any team made up of

strength and weakness is a weak team. Captain Kinnison, our only Lensman, is, of course, the best man aboard this buzz buggy. Who would you pick for No. 2?"

"VanBuskirk, of course, the same as you did. I wasn't criticizing you, man, I was complimenting you; and thanking you, in a roundabout way, for giving me Henderson. He's got plenty of what it takes, too."

"It wasn't 'VanBuskirk, of course,' by any means," the quartermaster rejoined. "It's mighty hard to figure either you or Henderson third, to say nothing of fourth, in any kind of company, however fast—mentally or physically. However, it seemed to me that you fitted in better with the pilot. I could hand pick only two teams without getting caught at it—you spotted me as it was—but I think that I picked the two strongest teams possible. At least one of you will get through, for all the tea there is in China. If none of you four can make it, nobody could."

"Well, here's hoping, anyway. Thanks again. See you again some time, maybe. Clear ether!"

Chief Pilot Henderson had, a few minutes since, changed the course of the cruiser from right-line flight to fantastic, zigzag leaps through space, and now he turned frowningly to Kinnison.

"We'd better begin dumping them out pretty soon now, I think," he suggested. "We haven't detected anything yet, but according to the figures it won't be long now; and after they get their traps set we'll run out of time mighty quick."

"Right."

And then, one after another, but even so several light years apart in space, eighteen of the small boats were launched into the void. In the control room there were left only Henderson and Thorndyke with VanBuskirk and Kinnison, who were to be the last to leave.

"All right, Hen, now we'll try out your roulette-wheel director by chance,"

Kinnison said, then went on, in answer to Thorndyke's questioning glance: "A bouncing ball on an oscillating table. Every time the ball caroms off a pin it shifts the course through a fairly large, but entirely unpredictable angle. Pure chance—we thought it might cross them up a little."

Hair-line beams were connected from panels to pins, and soon four interested spectators looked on while, with no human guidance, the *Brittania* lurched and leaped even more erratically than she had done under Henderson's direction. Now, however, the ever-changing vectors of her course were as unexpected and surprising to her passengers as to any possible external observer.

ONE MORE LIFEBOAT left the enforcement vessel, and only the Lensman and his giant aide remained. While they were waiting the required few minutes before their own departure, Kinnison spoke.

"Bus, there's one more thing we ought to do, and I've just figured out how to do it. We don't want this ship to fall into the pirates' hands intact, as there's a lot of stuff in her that would probably be as new to them as it was to us. They know that we got the best of that ship of theirs, but they don't know what we did or how we did it. On the other hand, we want her to drive on as long as possible after we leave her. The farther away from us she gets, the better our chance of making our get-away."

"We should have something that will touch off those duodec torpedoes we have left—all seven of them at once—at the first touch of a spy beam; both to keep them from studying her and to do a little damage if possible. They'll go inert and pull her up close as soon as they get a tracer on her. Of course, we can't do it by stopping the spy ray altogether, with a spy screen, but I think I can establish an R7TX7M field outside our regular screens that will interfere





*With their DeLameters they undercut the hill—so that a great slide of soil and rock obliterated every sign of their visit.*

with a TK7 just enough—say one tenth of one per cent—to actuate a relay in the field-supporting beam.”

“One tenth of one per cent of one milliwatt is one microwatt, isn’t it? Not much power, I’d say, but that’s a little out of my line. You can do it, and do it before we run out of time, or you wouldn’t have suggested it. Go ahead. I’ll observe while you’re busy.”

Thus it came about that, a few minutes later, the immense sky rover of the Galactic Patrol darted along entirely untenanted. And it was her nonhuman helmsman, operating solely by chance, that prolonged the chase far more than even the most optimistic member of her crew could have hoped. For the pilots of the pirate pursuers were intelligent, and assumed that their quarry also was directed by intelligence. Therefore, they aimed their vessels for points toward which the *Brittania* should logically go; only and maddeningly to watch her go somewhere else.

Senselessly, she hurled herself directly toward enormous suns, once grazing one so nearly that the harrying pirates gasped at the foolhardiness of such exposure to lethal radiation. For no reason at all she shot straight backward, almost into a cluster of pirate craft, only to dash off on another unexpected tangent before the startled outlaws could lay a beam against her.

But finally she did it once too often. Flying between two vessels, she held her line the merest fraction of a second too long. Two tractors lashed out and the three vessels flashed together, zone to zone to zone. Then, instantly, the two pirate ships became inert, to anchor in space their wildly fleeing prey. Then spy beams licked out, to explore the *Brittania's* interior.

AT THE TOUCH of those beams, light and delicate as they were, the relay clicked and the torpedoes let go. Those frightful shells were so designed and so

charged that one of them could demolish any inert structure known to man. What of seven? There was an explosion to stagger the imagination and which must be left to the imagination, since no words in any language of the galaxy can describe it adequately.

The *Brittania*, literally blown to bits, partially fused and even partially volatilized by the inconceivable fury of the outburst, was hurled in all directions in streamers, droplets, chunks, and masses, each component part urged away from the center of pressure by the ragingly compressed gases of detonation. Furthermore, each component was now, of course, inert and therefore capable of giving up its full measure of kinetic energy to any inert object with which it should come in contact.

One mass of wreckage, so fiercely sped that its victim had time neither to dodge nor become inertialess, crashed full against the side of the nearer attacker. Meteorite screens flared brilliantly violet and went down. The full-driven wall shield held; but so terrific was the concussion that what few of the crew were not killed outright would take no interest in current events for many hours to come.

The other, slightly more distant attacker was more fortunate. Her commander had had time to render her inertialess, and as she rode lightly away, ahead of the outermost, most tenuous fringe of vapor, he reported succinctly to his headquarters all that had transpired. There was a brief interlude of silence.

Then a speaker gave tongue. “Helmuth, speaking for Boskone,” snapped from it. “Your report is neither complete nor conclusive. Find, study, photograph, and bring in to headquarters every fragment and particle pertaining to the wreckage, paying particular attention to all bodies or portions thereof.

“Helmuth, speaking for Boskone”

reared from the general-wave unscrambler. "Commanders of all vessels, of every class and tonnage, upon whatever mission bound, attention! The vessel referred to in our previous message has been destroyed, but it is feared that some or all of her personnel were allowed to escape. Every unit of that personnel must be killed before he has opportunity to communicate with any patrol base. Therefore cancel your present orders, whatever they may be, and proceed at maximum blast to the region previously designated. Scour that entire volume of space. Beam out of existence every vessel whose papers do not account unquestionably for every intelligent being aboard. Investigate every possible avenue of escape. More detailed orders will be given each of you upon your nearer approach to the neighborhood under search."

## IV.

SPACE-SUITED complete, except for helmets, and with those ready at hand, Kinnison and VanBuskirk sat in the tiny control room of their lifeboat as it drifted inert through interstellar space. Kinnison was poring over charts taken from the *Brittania's* pilot room; the sergeant gazed idly into a detector plate.

"No clear ether yet, I don't suppose," the captain remarked, as he rolled up a chart and tossed it aside.

"No let-up for a second; they're not taking any chances at all. Found out where we are? Alsakan ought to be whereabouts somewhere, hadn't it?"

"I've got our coordinate roughly. Alsakan would be fairly close for a ship, but it's out of the question for us. Nothing much inhabited around here, either, apparently; to say nothing of being civilized. Scarcely one to the block. Don't think I've been out here before. Have you?"

"Off my beat entirely. How long

do you figure it'll be before it's safe for us to blast off?"

"Can't start blasting until your plates are clear. Anything we can detect can detect us as soon as we start putting out power."

"We may be in for a spell of waiting then—" VanBuskirk broke off suddenly and his tone changed to one of tense excitement. "Great blasts of fire! Look at that!"

"Blinding blue blazes!" Kinnison exclaimed, staring into the plate. "With all macro-universal space and all the time in eternity to play around in, the blind god of chance had to bring her back here and now!"

For there, right in their laps, not a hundred miles away, lay the *Brittania* and her two pirate captors!

"Better go free, hadn't we?" whispered VanBuskirk.

"Daren't!" grunted Kinnison. "At this range they'd spot us in a split second. Acting like a hunk of loose metal's our only chance. We'll be able to dodge any flying chunks, I think. There she goes!"

From their coign of vantage the two patrolmen saw their gallant ship's terrific end, saw the one pirate vessel suffer collision with the flying fragment, saw the other escape inertialess, saw her disappear.

The inert pirate vessel had now almost exactly the same velocity as the lifeboat, both in speed and in direction; only very slowly were the large craft and the small approaching each other. Kinnison stood rigid, staring into his plate, his nervous hands grasping the switches whose closing, at the first sign of detection, would render them inertialess and would pour full blast into their driving projectors. But minute after minute passed and nothing happened.

"Why don't they do something?" he burst out, finally. "They know we're here. There isn't a detector made that could be badly enough out of order to

miss us at this distance. Why, they can see us from there, with no detectors at all!"

"Asleep, unconscious, or dead," VanBuskirk diagnosed. "And they certainly are not asleep. And believe me, Kim, that ship was nudged. It's quite possible that she was hit hard enough to lay out most of her crew cold—anyway enough of them to put her out of control. And say, it's a practical certainty that she has a standard emergency inlet port. How about it, huh?"

KINNISON'S MIND leaped eagerly at the daring suggestion of his subordinate, but he did not reply at once. Their first, their *only* duty, concerned the safety of two spools of tape. But if the lifeboat lay there inert until the pirates regained control of their craft; detection and capture were certain. The same fate was as certain should they attempt flight with all near-by space so full of enemy fliers. Therefore, hare-brained though it appeared at first glance, VanBuskirk's wild idea was actually the safest course!

"All right, Bus, we'll try it. We'll take a chance on going free and using a tenth of a dyne of drive for a hundredth of a second. Get into the lock with your magnets."

The lifeboats flashed against the pirate's armored side and the sergeant, by deftly manipulating his two small hand magnets, worked it rapidly along the steel plating toward the driving jets. There, in the conventional location just forward of the main driving projectors, was indeed the emergency inlet port, with its galactic-standard controls.

In a few minutes the two warriors were inside, dashing toward the control room. There Kinnison glanced at the board and heaved a sigh of relief.

"Fine! Same type as the one we studied. Same race, too," he went on, eyeing the motionless forms scattered

about the floor. Seizing one of the bodies, he propped it against a panel, thus obscuring a multiple lens.

"That's the eye overlooking the control room," he explained unnecessarily. "We can't cut their headquarters visibeam without creating suspicion, but we don't want them looking around in here until after we have done a little stage setting for them."

"But they'll get suspicious anyway when we go free," VanBuskirk protested.

"Sure, but we'll arrange for that later. First thing we've got to do is to make sure that all the crew, except possibly one or two in here, are really dead. Don't beam unless you have to; we want to make it look as though everybody got killed or fatally injured in the crash."

A complete tour of the vessel, with a grim and distasteful accompaniment, was made. Not all of the pirates were dead, or even disabled; but, unarmored as they were and taken completely by surprise, the survivors could offer but little resistance. A cargo port was opened and the *Britannia's* lifeboat was drawn inside. Then back to the control room, where Kinnison picked up another body and strode to the main panels.

"This fellow," he announced, "was hurt badly, but managed to get to the board. He threw in the free switch, like this, and then full-blast drive, so. Then he pulled himself over to the steering globe and tried to lay the pointers back toward headquarters, but couldn't quite make it. He died with the course set right there. Not exactly toward the solar system, you notice—that would be too much of a coincidence—but close enough to help a lot. His bracelet got caught in the guard, like this. There is clear evidence as to exactly what happened. Now we'll get out of range of that eye, and let the body that's covering it float away naturally."

"Now what?" asked VanBuskirk, after the two had hidden themselves.



"Nothing whatever until we have to," was the reply. "Wish we could go on like this for a couple of weeks, but there's not a chance. Headquarters will get curious pretty quick as to why we're shoving off."

EVEN as he spoke a furious burst of noise erupted from the communicator; a noise which meant:

"Vessel F47U596! Where are you going; and why? Report!"

At that brusque command one of the still forms struggled weakly to its knees and tried to frame words, but fell back dead.

"Perfect!" Kinnison breathed into VanBuskirk's ear. "Couldn't have been better. Now they'll probably take their time about rounding us up. Listen, here comes some more."

The communicator was again sending. "See if you can get a direction on their transmitter!"

"If there are any survivors able to report, do so at once!" Kinnison understood the dynamic cone to say. Then the voice moderating, as though the speaker had turned from his microphone to some one near-by, it went on, "No one answers, sir. This, you know, is the ship that was lying closest to the new patrol ship when she exploded; so close that her navigator did not have time to go free before collision with the debris. The crew were apparently all killed or incapacitated by the shock."

"If any of the officers survive have them brought in for trial," a more distant voice commanded, savagely. "Boskone has no use for bunglers except to serve as examples. Have the ship seized and returned here as soon as possible."

"Could you trace it, Bus?" Kinnison demanded. "Even one line on their headquarters would be mighty useful."

"No, it came in scrambled—couldn't separate it from the rest of the static out there. Now what?"

"Now we eat and sleep. Particularly and most emphatically, we sleep."

"Watches?"

"No need; I'll be awakened in plenty of time if anything happens. My Lens, you know."

They ate ravenously and slept prodigiously; then ate and slept again. Rested and refreshed, they studied charts, but VanBuskirk's mind was very evidently not upon the maps before them.

"You understand that jargon, and it doesn't even sound like a language to me," he pondered. "It's the Lens, of course. Maybe it's something that shouldn't be talked about?"

"No secret—not among us, at least," Kinnison assured him. "The Lens receives as pure thought any pattern of force which represents, or is in any way connected with, thought. My brain receives this thought in English, since that is my native language. At the same time my ears are practically out of circuit, so that I actually hear the English language instead of whatever noise is being made. I do not hear the foreign sounds at all. Therefore, I haven't the slightest idea what the pirates' language sounds like, since I have never heard any of it."

"Conversely, when I want to talk to some one who doesn't know any language I do, I simply think into the Lens and direct its force at him. He thinks I'm talking to him in his own mother tongue. Thus, you are hearing me now in perfect Valerian Dutch, even though you know that I can speak only a dozen or so words of it, and those with a vile American accent. Also, you are hearing it in my voice, even though you know I am actually not saying a word, since you can see that my mouth is wide open and that neither my lips, tongue, nor vocal cords are moving. If you were a Frenchman you would be hearing this in French; or, if you were a Manarkian and couldn't talk at all, you

would be getting it as regular Manarkan telepathy."

"Oh—I see—I think," the astounded Dutchman gulped. "Then why couldn't you talk back to them through their phones?"

"Because the Lens, although a mighty fine and versatile thing, is not omnipotent," Kinnison replied, dryly. "It sends out only thought; and thought waves, lying below the level of the ether, cannot affect a microphone. The microphone, not being itself intelligent, cannot receive thought. Of course, I can broadcast a thought—everybody does, more or less—but even with the full amplification of the Lens the range is very limited. In Lens-to-Lens communication we can cover real distances, but without a Lens at the other end I can cover only a few thousand kilometers. Of course, power increases with practice, and I'm not very good at it yet."

"You can receive a thought—Everybody broadcasts—Then you can read minds?" VanBuskirk stated, rather than asked.

"When I so will it, yes. That was what I was doing while we were mopping up. I demanded the galactic coordinates of their base from every one of them alive, but none of them knew them. I got a lot of pictures and descriptions of the buildings, layout, arrangements and personnel of the base, but not a hint as to its location in space. The navigators were all dead, and not even the Arisians understand death. But that's getting pretty deeply into philosophy and its time to eat again. Let's go!"

DAYS PASSED uneventfully, but finally the communicator again began to talk. Two pirate ships were closing in upon the supposedly derelict cruiser, discussing with each other the exact point of convergence of the three courses.

"I was hoping that we'd be able to

communicate with base before they caught up with us," Kinnison remarked. "But I guess it's no dice—the ether's as full of interference as ever. They're a suspicious bunch, and they aren't going to let us get away with a single thing if they can help it. You've got that duplicate of their communications unscrambler built?"

"Yes. That was it you just listened to. I built it out of our own stuff, and I've gone over the whole ship with a cleaner. As far as I can see there isn't a trace, not even a fingerprint, to show that anybody except her own crew has ever been aboard."

"Good work! This course takes us right through a planetary system in a few minutes and we'll have to unload there. Let's see. This chart marks planets two and three as inhabited, but with a red reference number, twenty-seven. That means practically unexplored and unknown. No patrol representation or connection—no commerce—state of civilization unknown—visited only once, in the Third Galactic Survey. That was in the days of the semi-inert drive, when it took years to cross the galaxy. Not so good, apparently—but maybe all the better for us; at that. Anyway, it's a forced landing, so get ready to shove off."

They boarded their lifeboat, placed it in the cargo lock, opened the outer port upon its automatic block, and waited. At their awful galactic speed the diameter of a solar system would be traversed in such a small fraction of a second that observation would be impossible, to say nothing of computation. They would have to act first and compute later.

They flashed into the strange system. A planet loomed terrifying close—at their frightful velocity almost invisible even upon their ultra-vision plates. The lifeboat shot out, becoming inert as it passed the screen. The cargo port swung shut. Luck had been with them;

the planet was scarcely a million miles away. While VanBuskirk drove toward it, Kinnison made hasty observations.

"Could have been better—but could have been a lot worse," he reported. "This is Planet 4. Uninhabited, which is very good. Three, though, is clear over across the Sun, and Two isn't any too close for a space-sun flight—better than eighty million miles. Easy enough as far as distance goes—we've all made longer hops in our suits—but we'll be open to detection for at least twenty minutes. Can't be helped, though. Here we are!"

"Going to land her free, huh?" VanBuskirk whistled. "What a chance!"

"It'd be a bigger one to take the time to land her inert. Her power will hold—I hope. We'll inert her and match velocities with her when we come back. We'll have more time then."

THE LIFEBOAT stopped instantaneously, in a free landing, upon the uninhabited, desolate, rocky soil of the strange world. Without a word the two men leaped out, carrying fully packed knapsacks. A portable projector was then dragged out and its fierce beam directed into the base of the hill beside which they had landed. A cavern was quickly made, and while its glassy walls were still smoking-hot the lifeboat was driven within it. With their DeLam-

eters the two wayfarers then undercut the hill, so that a great slide of soil and rock obliterated every sign of the visit. Kinnison and VanBuskirk could find their vessel again, from their accurately taken bearings; but, they hoped, no one else could.

Then, still without a word, the two adventurers flashed upward. The atmosphere of the planet, tenuous and cold though it was, nevertheless, so sorely impeded their progress, that minutes of precious time were required for the driving projectors of their suits to force them through its thin layer. Eventually, however, they were in interplanetary space and were flying at quadruple the speed of light. Then VanBuskirk spoke.

"Landing the boat, hiding it, and this trip are the danger spots. Heard anything yet?"

"No, and I don't believe we will. I think probably we've lost them completely. Won't know definitely, though, until after they catch the ship, and that won't be for ten minutes yet. We'll be landed by then."

A world now loomed beneath them, a pleasant, Earthly-appearing world of scattered clouds, green forests, rolling plains, wooded and snow-capped mountain ranges, and rolling oceans. Here and there were to be seen what looked like cities, but Kinnison gave them a wide berth, electing to land upon an

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open meadow in the shelter of a towering black and glassy cliff.

"Ah, just in time; they're beginning to talk," Kinnison announced. "Unimportant stuff yet, opening the ship and so on. I'll relay the talk as nearly verbatim as possible when it gets interesting." He fell silent, then went on in a singsong tone, as though he were reciting from memory, which, in effect, he was:

"Captains of ships P4J263 and EQ769B47 calling Helmuth! We have stopped and have boarded the F47U569. Everything is in order and as deduced and reported by your observers. Every one aboard is dead. They did not all die at the same time, but they all died from the effects of the collision. There is no trace of outside interference and all the personnel are accounted for."

"Helmuth, speaking for Boskone. Your report is inconclusive. Search the ship minutely for tracks, prints, scratches. Note any missing supplies or misplaced items of equipment. Study carefully all mechanisms, particularly converters and communicators, for signs of tampering or dismantling."

"Whew!" whistled Kinnison. "They'll find where you took that communicator apart, Bus, just as sure as hell's a man-trap!"

"No, they won't," declared VanBuskirk as positively. "I did it with rubber-nosed pliers, and if I left a scratch or a scar or a print on it I'll eat it, tubes and all!"

A pause.

"We have studied everything most carefully, O Helmuth, and find no trace of tampering or visit."

"Helmuth again: 'Your report is still inconclusive. Whoever did what has been done is probably a Lensman, and certainly has brains. Give me the present recorded serial number of all port openings, and the exact number of times you have opened each port.'

"Ouch!" groaned Kinnison. "If that means what I think it does, all hell's out for noon. Did you see any numbering recorders on those ports? I didn't. Of course, neither of us thought of such a thing. Shut up, here comes some more stuff."

"Port-opening recorder serial numbers are as follows.' They don't mean a thing to us. 'We have opened the emergency inlet port once and the starboard lock twice. No other port at all.'"

"And here's Helmuth again: 'Ah, as I thought. The emergency port was opened once by outsiders, and the starboard cargo port twice. The Lensman came aboard, headed the ship toward Sol, took his lifeboat aboard, listened to us, and departed at his leisure. And this in the very midst of our fleet, the entire personnel of which was supposed to be looking for him! How supposedly intelligent spacemen could be guilty of such utter and indefensible stupidity?"

"He's tellin' 'em plenty, Bus, but there's no use repeating it. The tone can't be reproduced, and it's simply taking the hide right off their backs. Here's some more: 'General broadcast! Ship F47U596 in its supposedly derelict condition flew from the point of destruction of the patrol ship, on course longitude three five one point two seven degrees, latitude five point two three degrees, distance twenty-four thousand seven hundred parsecs. Cancel all previous orders and investigate.' No use repeating it, Bus, he's simply giving directions for scouring our whole line of flight. Fading out—they're going on, or back. This outfit, of course, is good for only the closest kind of close-up work."

"And we're out of the frying pan into the fire, huh?"

"Oh, no; we're a lot better off than we were. We're on a planet and not using any power that they can trace. Also, they've got to cover so much terri-



story that they can't comb it very fine, and that gives the rest of the fellows a break. Furthermore—"

A CRUSHING WEIGHT descended upon his back, and the two found themselves fighting for their lives. From the bare, supposedly safe rock face of the cliff there had emerged rope-tentacled monstrosities in a ravenously attacking swarm. In the raving blasts of DeLameters hundreds of the gargoyle horde vanished in vivid flashes of radiance, but on they came, by thousands and, it seemed, by millions, dashing madly toward them.

Eventually, the batteries energizing the projectors became exhausted. Then flailing coil met shearing steel, fierce-driven parrot beaks clanged against space-tempered armor, bulbous heads pulped under hard-swung axes; but not for the fractional second necessary for inertialess flight could the two patrolmen win clear. Then Kinnison sent out his S O S.

"A Lensman calling help! A Lensman calling help!" he broadcast with the full power of mind and Lens.

Immediately a high, girlish voice poured into his brain: "Coming, wearer of the Lens! Coming at speed to the

cliff of the Catalats. Hold until I come! I arrive in thirty—"

Thirty what? What possible intelligible relative measure of that unknown and unknowable concept, time, can be conveyed by thought alone?

"Keep slugging, Bus!" Kinnison panted. "Help is on the way. A local cop—voice sounds like a woman—will be here in thirty somethings. Don't know whether it's thirty minutes or thirty days; but we'll still be here."

"Maybe so and maybe not," grunted the Dutchman. "Something's coming besides help. Look up and see if you see what I think I do."

Kinnison did. Through the air from the top of the cliff there was hurtling downward toward them a veritable dragon: a nightmare's horror of hideously reptilian head, of leathern wings, of viciously fanged jaws, of frightfully taloned feet, of multiple knotty arms, of long, sinuous, heavily scaled serpent's body. In fleeting glimpses through the writhing tentacles of his opponents Kinnison perceived, little by little, the full picture of that unbelievable monstrosity; and, accustomed as he was to the outlandish denizens of worlds even yet scarcely known to man, his very senses reeled at the sight.

*To be Continued.*

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**Don't miss the next installment of this story as it builds up the fabric of one of the greatest science novels ever written. Tell your friends to get their copies of this issue before it is exhausted.**

# WHEN THE SUN

— and after that—moonshine—

WHATEVER gods decreed the sinking of Atlantis, the great Biblical deluge, and the ice ages, decreed also the burning out of the sun. A planet that had witnessed these other things, and a host of lesser catastrophes, darkened now as the central luminary died a mysterious death. Mysterious, because the science of the little, two-legged, upright creatures living on earth's surface could find no reason for the phenomenon. Their glib theories had demanded that the sun continue to puff away its vast bulk in radiant energy, at the rate of thousands of tons per second, for billions of years. Earth, they cried, must continue to receive its portion of this invisible power for those many ages. That was down on paper. That had to be.

This thing could not happen, which was happening. Yet the sun dimmed, cooled and shrank, and the denials of the scientific members of the race inhabiting the third planet failed in the slightest to stop the process. A celestial phenomenon that may have happened countless times before, in the greater cosmos, pursued its relentless course, draining a planetary family of its light and heat, depriving a world of its life-giving radiation.

The warm rays that had once bathed earth and given it life no longer performed this beneficent duty. As a result, earth's surface underwent a great change. The average temperature went down, degree by degree, in company with the paling of the sun. Soon all fresh-water bodies had frozen permanently solid. Not long after, the mighty oceans congealed, never to thaw

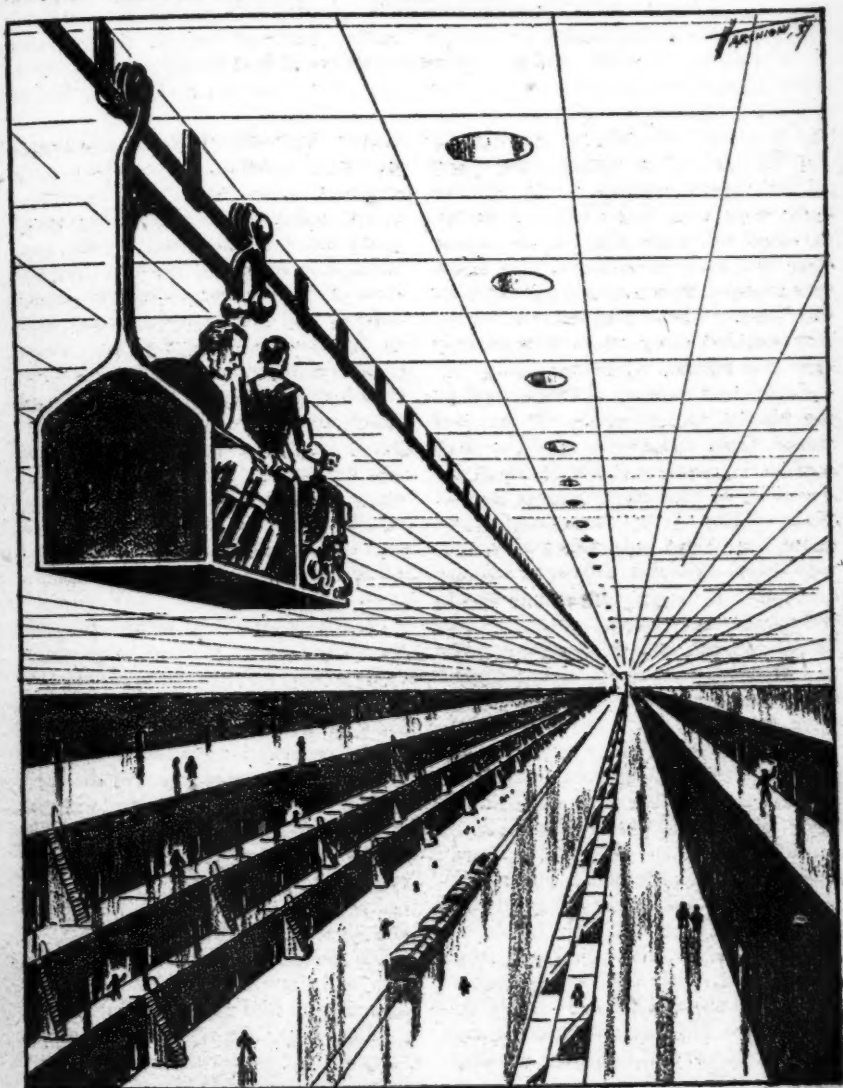
again. The tides piled ice heaps near the coast lines and left the centers as tremendous hollows. Like giant convex mirrors, these reflected the dying sunlight to a focus, as though trying to collect the miserable remains of radiation. As all the waters froze, the expanding ice creaked and crawled inland for miles, piled in titanic and fantastic heaps, sprinkled with precipitated salts.

Down and down went the mercury threads of the little instruments the two-legged creatures had. Bulging eyes read the figures; chattering teeth whispered them out; blue-cold fingers set up thermometers graded in the absolute scale down to a final zero, and traced the dial needles as they swung toward a madness.

Once the waters of earth had given up their liquid state, the atmosphere disgorged its diffused moisture in a final deluge of snow and frost. For one entire revolution of the moon, a sifting of crystalline water feathered from the heavens over a freezing world. Denuded of clouds, dust and all except its pure gaseous components, the desiccated atmosphere blew its pure, cold breath over a planet shrouded in white, as though in wake over the sheeted corpse of earth.

But it was not long after that that the atmosphere itself grew heavy and thick, as a deep, increasing twilight came over all. When the stars had begun to shine in the sky with the weakened sun, droplets of liquid air gathered and obeyed the immutable law of gravity. Falling to the ground, they formed in silent blue pools and grew with amoeboid rapidity. Finally, these

# WENT OUT



Below stretched one part of the underworld city that housed the last of humanity—every available inch used scientifically.

by  
Eando Binder

lakes of gelid fluids solidified and the remaining gases drifted to the surface as a fine snow. In repetition of a man-made experiment on a macrocosmic scale, hydrogen precipitated as a shiny frost moistened with liquid helium. Then the helium locked its molecules in the embrace of crystalline rigidity.

OVERHEAD a gloomy sun, shorn of its former coronal glory, trickled futile rays over this planetary corpse. It could not wake the life and bustle that had once been there. Its pitted face changed from a ruddy glow to utter blackness. The midnight shadows of star-speckled space swept triumphantly over this planetary system.

In a short century, as measured by the bipedal race of earth, the sun had waned from a superhot globe with a surface temperature of six thousand degrees to a blackened, lifeless cinder. Some Milky Way astronomer, close enough to ferret out such a tiny star, may have observed this solar demise and linked it with similar star deaths in the parade of eternities. Mankind had taken account only of bursting novæ and flaming suns—he had not known of the many cold, dark star corpses peopling the void.

Life had wilted rapidly on earth, during that period. Deprived of the normal actinic radiation with which it had built its tissues, planet life withered away like dream stuff. The hardy mosses of the North held out till a drifting of carbon-dioxide frost froze the sap within them. As the hen beside the bushel of wheat, they died with their natural food supply piled beside them.

Herbivorous animal life closely followed plant life into extinction, except for a brief flurry of desperate carnivorousness. The carnivores preyed one another to annihilation. Perhaps some last lion roamed a chilly, blighted world and wondered why there was no game, not knowing that he was the last.

Piscatorial and all other sea life stayed on no longer than the complete freezing of the oceans. Insects and other forms of a numerous and hardy nature survived beyond the existence of a normal food supply, in a suspended animation. It was a sleep that had no awakening.

The fauna and flora of earth were a dream of the past.

And man?

He had watched the planets vanish from the sky, unlighted by the great celestial lantern. He had seen the moon, once a magnificent sphere of argent, fade to dull gray and finally lose itself in the blankness of the void.

These bipedal, thinking creatures, whose ravings had proclaimed the sun death impossible by their *theory*, after swallowing the bitter pill of the incredible happening, attempted to forestall fate. With an indomitable spirit they cast about for an escape from the doom that had wiped clean their world of all other life—

PHIL WACKER looked out over the face of earth, gripped in an eternal superwinter, through the one window of his dwelling. It was a square stone building whose walls had been meticulously cemented to make the interior airtight. Three quarters of the large, single room were taken up with the paraphernalia of a laboratory. The remaining space, partitioned off by a rough, cheap weave hung from the low ceiling, was the bedroom for himself and his wife.

He looked down at her troubled face now and drew her into his arms. She looked up at him with eyes that pleaded.

"But, dear," he remonstrated gently, "I can't take you with me. You know those absent-minded fits Greeley has, when his mind seems to wander—" He broke off and jerked his head significantly at the stoop-shouldered man whose gray head bobbed over the work



bench in the far corner, near the cot on which he slept.

The young wife shuddered. "Greeley and his fits scare me sometimes," she whispered. "And every time I glance out of the window at that utter desolation——"

"Yes, I know," muttered the young husband gloomily. Then he brightened. "But once I've achieved atomic power, all that will be over. Mankind will be able to climb out of the ground and become more of a man, less of a worm."

The young wife sighed. So many times had he said that in the past ten years. Always so much hope, and always so many disappointments in his research. He was brilliant, perhaps near his goal, but in the meantime they suffered from cold, from harsh foods, and from vague terror inspired by the scene outside. And there was Greeley with the queer eyes, a willing helper and gentle of spirit, but with a mind that wandered at times. He would mutter strange things, with mad little dancing lights in his eyes. Maida had described them to her husband but he had scoffed. Greeley, he said, was old and perhaps a bit scatter-brained, but quite harmless and amazingly keen on mathematics.

"Maida, do you know what it will mean to live on the surface?" continued the young scientist. "In cities warmed and lighted by atomic power? Our people won't have to scratch and slave and bump their heads for very lack of room, as underground."

"On the surface we will be free and rich and happy. Mankind had its troubles in those days before the sun went out, but nothing like the miseries we have now. There were millions upon millions then, and thousands of surface cities. They roamed over the face of earth freely. There was laughter, sunshine——" He choked for breath.

The young wife was puzzled. Her lips moved tremulously. "Sunshine!

What can that be like? It's just a word to us. We were born in this world of dark, though we had a heritage of light. What can sunshine be like?"

"I don't know myself," admitted the man, with a trace of wonder in his voice. "It must be far stronger than our oil lamps."

"Sunshine?" said the aged assistant querulously, turning around. He had overheard the last. "My grandfather told me of it. He saw it at its best. It was glorious. So was moonlight, he said. Not glaring, but——"

"Yes, Greeley," interposed Wacker, impatient to be off. "I'm leaving now. Remember about the neutron gun. You know the danger of letting it run too long. I'll be back to-morrow."

Greeley nodded and turned back toward his work bench, shaking his old head. "Sunlight and moonshine," he mumbled vaguely. "Moonshine? My grandfather mentioned that, too——"

Wacker strode to a wall cupboard from which he extracted a jumper outfit of thick neo-rubber, resilient at the extremes of low temperature. Maida kissed him, then helped him fit the aluminium helmet over his head and join it to the neck piece with liquid neo-rubber. Waving a farewell, the young scientist swung open the felt-lined lock door, stepped into the dark interior of the seal.

A moment later Maida heard the soft clang of the outer lock. Shivering from the breath of intense cold that seeped from the lock chamber every time it was used, she hugged herself with her arms, then threw a scoop of coal into the one stove the place had.

She basked in its warmth for a moment, frowning in thought. A little later she stepped to the window and looked out, trying to picture what sunlight could be like, how it could light up that fearful arctic waste stretching from horizon to horizon. Finally she shuddered from more than cold and

drew the curtain across the window with a decisive jerk. The supernal chill of that outside scene had seemed to congeal her very heart.

In his corner, old Greeley muttered away. "My grandfather said sunshine warmed you outside and moonshine warmed you inside. If I could have one or the other, I'd be satisfied. This way I'm cold, cold, cold both inside and out. No sunshine, just cold, cold, cold——"

PHIL WACKER found breathing hard by the time he had left the air lock and stepped outside. He strode to the near-by drift of solidified air, scraped away the upper layers, which contained hydrogen and helium to excess, and scooped his heavily gloved hand into the virgin air snow. He stuffed several handfuls into the container on his chest and opened the valves carefully. The little battery that heated the interior of his suit also warmed the resistance coil over which the cold gases flowed on their way in. He took a deep breath of fresh air.

After an exhaustive flexing of his legs and arms to see that the suit was quite fit to preserve life from the demons of cold and airlessness, Wacker began his journey.

He swung along in the stiff air suit. Through his vision plate the ultra-frigid wastes greeted him mockingly. The ice god had usurped a world that had once been his and his peoples, and had driven them underground, with the worms.

He passed one of his landmarks on the way to the underworld, a half-tumbled skeleton tower of steel. But the metal was not visible; it was coated over with a foot thickness of icy substance. This had once been a radio aerial, broadcasting to the great surface world that was no more. In the dim, starlighted distance he could see the ruins of the former smoky city of Pittsburgh, now embedded in a cocoon of white.

Wacker continued into the white barrens. At times he had to skirt stupendous ice heaps whose spires refracted the starlight in spectrum sheen. It was an eerie world, dark and haunted, brooding with death. Try as he might, Wacker could not picture the surface world free of ice and air snow, laved by a warmed atmosphere, brilliantly illumined by a blazing sun. It seemed a dream of the past that had never been true.

Yet with atomic energy there *could* be such a world——

An hour after he had left his wife there loomed out of the darkness a large, hemispherical structure from whose circle of windows gleamed man-made light. The sight quickened Wacker's pulse, drove away the chill depression that the lonely trek over the frozen wastes had lodged in his heart. As he came nearer he saw the electrically driven snow vehicle with its train of loaded cars delivering air snow to the tubes for underground use. He wandered into the dumping shed and watched the air-suited men open the bottom traps of the cars over the gratings which sifted the air snow down into a large hold. Here it began to liquefy and was pumped to the various ventilation units of the subterranean city.

Wacker filed into the airlock with the men and stepped in their company into the warmed and lighted quarters that took up half the dome. Air suits were doffed with grins of pleasure.

"Ah, warmth!" muttered one man, rubbing hands that were blue with cold. "What a blessing."

"I'll be happy," moaned another man with pinched lips, "if my next detail is tending the heat shafts. But I don't think I'll ever be warm again. There's ice in my veins."

"I have three weeks more of this icy hell," vouchsafed another bitterly.

A bell clanged loudly. The men jumped up eagerly. "At least the food

will be warm!" shouted a voice with almost a cheery note in it.

They filed through a door toward the dining hall. From another door came the next shift of air-snow gleaners, for to them the bell had been the signal to leave. They donned their air suits in silence, with dispirited faces. It was a grim task ahead of them, and now and then one of the men did not come back. None knew when it might be his turn to stretch his frozen body out in the ruthless wastes.

Wacker hung his air suit carefully in a wall-locker. He rubbed his face to start a circulation that seemed to have stopped and made his way down a corridor toward the elevator that plied the depths. He greeted the attendant before the grill-work cage.

"Elevator due in two minutes," informed the attendant. His voice was flat, toneless. Fifty years of life in the hardships of that existence had worn his spirit thin. His thoughts, when they weren't bitter, were blank.

"Has my shipment of coal arrived?" asked Wacker.

"Two hundred pounds. We'll pack it on a sled for you to take back with you on your return."

"Only two hundred pounds!" exclaimed the young scientist. "I ordered five hundred, as usual. Why have they cut it down?"

The other shrugged. "You'll have to see the commissioner of supplies about that." He got up to swing open the cage doors as the elevator came up.

A HALF DOZEN MEN stepped out and lent a hand to the unloading of the freight that had been brought up—supplies for the little community under the dome. These men were to stay for a month on the air-foraging detail. Wacker stepped into the elevator with a half dozen other men who had finished their month's stretch loading air snow. They were obviously happy to leave the

surface world, much like, in reverse order, the miners of previous times had been glad to go back to the surface world.

Five hundred feet below, the elevator car stopped. The passengers filed, one by one, before an attendant, who checked each one off and sent him to his next detail. Those who had wives were allowed to make arrangements to have the same sleeping quarters.

"Wacker?" said the checker. "Oh, yes. Your monthly visit. Supply department, as usual?"

"I think I'll have to see the commissioner of supplies himself, to order some special materials," returned the young scientist.

Ten minutes later, after putting through the necessary calls by telephone, the attendant handed Wacker a ticket. "Elevator 23 to the second level and monorail car, blue line, to the office."

Wacker took the punched pasteboard and boarded the proper elevator downward to the second level. Here a noisy, crawling monorail car carried him jerkily along the ceiling of the second level. Below stretched one part of the underworld city that housed the last of humanity. It was a circular cavern, a mile in diameter, on the floor of which had been built a continuous honey-combed structure. Every available inch had been used scientifically, up to within twenty feet of the flat ceiling. This open space was reserved for the monorail system and for circulation of air.

There were nine other levels, similar in arrangement. It was like a gigantic beehive in all, and though the inhabitants were men, they labored with the business of the bee to keep this community in smooth-running order. There could be no shirkers, no useless drones, in this subterranean city—nor any privileged class. All were workers, and mere existence taxed their combined efforts.

Two centuries before, when the re-

alization of doom had crashed upon humanity, a group of scientists and engineers had conceived this refuge from the coming catastrophe. Support had been at first scanty, then overabundant, as the hoped-for revival of the sun failed to appear with the passing years. Other such projects had been started by other groups, but had not started soon enough, nor been planned carefully enough.

When the first blight of a superarctic cold began to lay waste the upper world, only this underground habitation was fit to protect life. There had been the awful event of panic-stricken millions trying to squeeze into a space designed only for thousands. Military defenses, set up in forethought, had slaughtered those many who tried to storm the place, after the chosen few had entered. Not long after, the forces of nature carried on the massacre on a world-wide scale.

Man had been wiped out, except for this little community in the bowels of earth. There had been many problems to solve. Before the air above had fallen to earth as an easily garnished snow, they had had to take in gaseous atmosphere, heating it. There had been a shortage of almost everything from the first.

Food, however, had been stocked up for a ten-year period. The scientific members of the group, composing fully half their number, worked as never before to solve the food problem after the surplus was gone. A process was finally perfected for converting the life-form *lumbricus* into a fairly palatable and nutritious gelatine, salted with cultures of algæ that could be raised under the ultra-violet ray.

The upper cold had driven the vast army of earthworms downward, into the very vats of the scientists. The unappreciated worm, fertilizing man's fields for him before the sun went out, now supplied him with food.

The survivors had then settled down grimly to the task of existing in the face

of all odds. They had carried down with them as much of machinery, supplies, books and worthwhile things as possible, but there had been a strict and miserly limit to everything. They had enough, however, to start the wheels of civilization below ground.

Mining operations had begun. The original planners, in their great wisdom, had selected a spot near coal, oil and iron deposits in western Pennsylvania. Questing tunnels went to each and made use of these precious materials. Like a mechanical-minded mole, man forged a Vulcan's workshop in the depths.

While merciless natural forces denuded a world above of life, these diligent humans created a new nether life. Everything was at a premium, and there was barely enough for all, but life went on below while death triumphed above.

Wacker caught something of the grandeur of this brave stand against oblivion as he stood on the landing roof waiting for his appointment. Much had been written in previous times of the pettiness of man's goals, the futility of civilization, the faults and silly prides of men. But this fight against the blind omnipotence of the all-powerful universe had brought one thing in sharp relief: mankind's indomitable spirit. In itself and of itself, it was something sublime.

THE commissioner of supplies, Fenwick, was one of a dozen men who controlled the destinies of the twenty thousand souls in the community. He had the same pinched look of malnutrition they all had, and the same dead-white skin. His brow carried deep wrinkles of worry and care. His eyes were bleak in their depths. The administrators sometimes knew too closely how starkly near to extinction they were, if certain misfortune should come at once.

Greetings were short. "Well, Wacker, what is it?"

"I'd like to have my quota of batteries



increased," began the young scientist with a deep breath. "I'm nearing an important part of my researches. You recall that my approach had been through neutron bombardment of argon-fluorine compounds. These are not only chemically unstable, but atomically as well. As I load these sensitive compounds with neutrons, they go through a series of transitions—transmutations, in fact—each radiating more energy than was originally put in— But not enough more, as yet, to make it practicable. I hope to reach a transition substance that will release its atomic energy in generous amounts. In fact, in colossal amounts."

"And blow yourself to atoms, I suppose," mused the commissioner.

Wacker shrugged. "That's why you have me on the surface, and three miles from the outlet. It's dangerous stuff, but I think I can control it once I get it. I will need more battery power, and more—"

"And what more?" snapped the official at Wacker's pause.

The young scientist reached in his pocket for a paper and extended the list. Fenwick's lips pursed as he read the items. Then he looked up half angrily.

"Outrageous. You're asking too much. You know how limited our supplies are of everything. If I grant you all this stock, there'll be shortage of material for the food labs. They're doing something important down there—growing amoeboid colonies in earthworm cultures. They will revolutionize our food problem, for the new gelatine is more nutritious. Should I take supplies from them to give to you—you and your mythical atomic power?"

Wacker, with an effort, ignored the implied sarcasm and said simply, "I need them."

The commissioner grinned mirthlessly and leaned back in his battered chair. "I suppose next you'll want a

complete new wardrobe, too. And you may as well ask for permission to have a child, for that's how little chance you have of getting these things." He tossed the list back.

"Then I don't get anything?" asked Wacker quietly.

Fenwick stared at him strangely. "Do you realize that the best of earth's scientists, before the sun went out, could not release the energy of the atom? They had splendid laboratories. It's nobody's fault, but your facilities are poor, and the rest is pure enthusiasm. You've worked ten years and doubtless could spend another thousand without reaching your goal. With your brilliant mind you would do far more good in the food labs."

Wacker said quietly, "Before the sun went out, scientists did not have the drive that is behind me. They did not have the goad of impending extinction to whip their minds to greater effort. What will we do when the earthworms die out, as they eventually must, and soon? You can't grow your amoeboid cultures on metal ores. What will we do when our coal and oil supplies give out? Our life underground is coming to a focal point of starvation and lack of power. Another ten or twenty years and our birth rate will be cut to zero. After that, it will be all over for the human race."

The young scientist's eyes blazed, his breath came short in emotion. "Some twisting of space snuffed the sun out like a candle, but that twist is gone. Atomic power could again bring life to the sun. With that same power in our hands, we will bring life to the upper world, for countless ages! We will become the men we should be, instead of worms, eating worms. We are near the secret, Greeley and I."

"GREELEY!" scoffed the commissioner. "His seventy-two-year-old brain is burned out—a husk of empty

thoughts." He saw twenty men die by freezing in their air suits, himself rescued in the eleventh hour from the bitter wastes—enough to drive any man mad. For years after, the very word 'cold' would make little mad lights come into his eyes."

Wacker remembered those times he and Maida had seen the old man standing before the window, shaking his fist at the frozen flats, muttering imprecations. In a way, that was the drive behind him. "Before that he was the foremost atomic physicist," defended Wacker. "He's been a great help to me, or perhaps I to him, and together we've come close to our aim, to atomic power. Fenwick, you've got to believe me—"

The commissioner sprang to his feet, began pacing the room. Suddenly, he turned with a haggard face. "Wacker, I wish I could believe you," he said uncertainly. "If you *were* right—" His eyes blazed for a moment, then dulled. He shook his head wearily.

"Yesterday there was a meeting of the council," he continued tonelessly. "In the course of business, your license as a research scientist on atomic physics was revoked. You are transferred to the food labs."

The young scientist stood stunned. "But I'm the only one working on atomic physics," he remonstrated wildly. "The only one in our entire community—on earth! If you take that away from me and destroy my laboratory, the last slender chance of discovering atomic power will be gone. The end will—"

Fenwick nodded. "I know," he murmured. "We talked the matter over for hours, decided at last that it was a chimera you were chasing. Ten years you've tried. You've used a tremendous amount of chemicals, apparatus, battery power. Pure research with no practical returns, was the verdict."

The commissioner saw the misery in

the young scientist's face. "It was a grand effort, my boy. You will be remembered for it. That is"—his thoughts turned gloomy—"if there is any one to remember."

In the stark realism of the moment, the bare exposure of hidden thoughts, the commissioner did not realize quite what he was saying, as he went on, with the misery of ages in his eyes. "Life will be gone soon, totally extinct. What is life? A chemical reaction, a spawn of heat. It does not exist in space, nor in space cold, which makes up most of the cosmos. Heat is a special condition of space. The stars are transitory phenomena. They are born of the nebular veil, enjoy a brief glory, then wane to the heatless state of space. Some few stars have planetary systems, and some few planets, specially graced, mix nature's test tubes and begin a chemical reaction that carries on for an age or so, until the heat which catalyzed it puffs away. Such is the dream of life."

Wacker was muttering brokenly to himself. "Greeley was right after all. His brain, half mad, half wise, realized the vicious circle of futility our search for enlightenment is. What was it he said? 'The secret of atomic power, or of anything, lies just before our noses. It is there, within grasp, along with a billion other things—unwanted things, like a blue grain in a handful of yellow sand grains. But to find it calls for sublime luck. Man blunders along to great discoveries. His search is a blind groping. Now and then the wheels of the gods grind fortuitously and push something into his fingers.'

"Thus it is with our atomic energy. It lies up there in my laboratory, has been dangling before our faces for ten years. Greeley and I reached so many times—clasped only air, defeat. Given more time, we might clutch it to-morrow, or never in a thousand years. The law of chance, a cosmic gamble, rules

our lives and all the universe. And it has not stopped for our number."

A BUZZ filled the room suddenly. Fenwick sat down at his desk to answer the phone. After a moment of listening, he hung up and looked at Wacker queerly. "There's been a radio signal from your wife. Seems there's been trouble——"

"Quick!" yelled Wacker. "Where's the nearest radiosonic unit?"

"Level 4. I'll go with you."

Together, they took an elevator downward, admitted immediately by the attendants upon recognition of the commissioner. On the way Wacker explained how his wife was able to communicate by wireless when the only known radio sets were sparingly used as sonic apparatus in their mining projects, and occasionally for communication in great emergency.

"I did some exploring in the ruins of Pittsburgh near my lab on one occasion, and found a complete transmitting outfit frozen in a block of ice. I took block and all on my sled, thawed it out, and set it to working. It's simply a low-wave set in the ten-meter band. I told my wife how to hook it up with our battery current and signal in case of emergency. I just wonder now if Greeley——"

Maida's voice came over the sonic set, metallic and faint, her words distorted by cracklings. "Phil, I'm terribly frightened. It's Greeley! He's been acting very queerly—worse than ever before, and different somehow. He has a glassy look in his eyes and sings crazy things and mumbles. Worst of all, he's let the charge build up to five thousand megavolts and refuses to turn it off. The place is overheated dreadfully now. That look in his eyes——"

"Maida, for Heaven's sake get away from there!" His voice a hoarse, anguished shout, Wacker went on, "Get

into your air suit and head for the dome. You know the way alone. Can you get Greeley to talk to me? No—don't take the time——"

Then Greeley's voice came, preceded by a queer cackle. "Sunlight, Phil. Yes, nice warm sunlight and moonlight. Moonlight? No, I mean moonshine. That's better. Sunlight warms you outside and moonshine heats your blood. And I was so cold. But not now. Oh, no, I've fixed that. I——"

"Greeley, you fool!" roared Wacker, so that the microphone rattled. "What have you done? Turn off the neutron gun before you blow yourself and the laboratory to atoms."

"Atoms? Sunshine from the atoms; of course. That's right, m'boy. And moonshine——"

"I knew his mind would crack some day," moaned Wacker to the commissioner, standing helplessly at his side. "He'll blow the place to kingdom come. He's gone utterly crazy."

"Crazy, eh?" The words crackled sharply from the sonic recorder. The old scientist's voice went on, suddenly quite lucid and firm, "Yes, Phil, I'm either utterly crazy or strangely sane. Depends on how you look at it. Is it crazy to hope that some day the sun will come to life again? Light our world and give us blessed heat? We've been so cold, so frozen, but perhaps the sun will blaze in its former incandescence and give us the magic of sunlight. And moonlight, too." The voice cracked. "Moonshine, that, too."

"You're mad, mad!" roared Wacker. "Turn off the neutron gun, Greeley. You must have a spark of sanity left."

THERE WAS a moment of silence, but the uneven hum of the surface transmitter continued. At last Greeley's voice modulated in once more, fading with a waning battery supply. "The dials show seven thousand five hundred

megavolts absorbed, Phil. And it has not yet blown up. Let's see, it will take you about three hours to get here. I will shut off the neutron gun in two and a half hours—if it hasn't flung me to the stars by then. Come straight here, m'lad, and bring a gram of tantalum metal with you, which is important. Your wife has gone in her air suit."

Wacker breathed a silent prayer of thanks, then spoke into the sonic machine, pleadingly. "Greeley, you must be a madman to do what you're doing. For the last time——"

"Bring the tantalum metal," came back Greeley's voice in a sharp scream. "Sunlight, eh? And moonshine. Oh, yes, that, too."

His voice clicked out. Wacker whirled on the commissioner. "I don't know what's going on in that old head of his, but—well, I'll bring him that gram of tantalum."

Fenwick hesitated. "I've been ordered not to allow you any more supplies. In three days your license——"

"For Heaven's sake, give me the three days then," exclaimed Wacker, "and a gram of tantalum! Just that one thing. There's one chance in a billion that old Greeley——"

They eyed one another for a moment. "Come on," said the commissioner suddenly. "Maybe I'm crazy, too, but I'm with you."

The gram of tantalum proved hard to find. Chemical stores were ransacked high and low before a foot length of fine wire was found. Once the commissioner had decided to give Wacker his support, he went the whole way. He had conducted the young scientist around personally. Now, since so much time had been lost, he put through an emergency call for special transportation to the surface. A trip that would have consumed over an hour in the jerky monorails and occasional elevators was accomplished in a few

minutes. He left Wacker at the final elevator, which would take him up to the surface dome.

"Good luck, Wacker," Fenwick said. His eyes had a strange fire in them, the embers of a faint hope.

THE ELEVATOR shot upward. Wacker stepped out under the dome, and into the arms of his wife.

"Don't go there, Phil!" she pleaded, when he told her of his destination. "Greeley's been saying all sorts of impossible things. You'll be killed. He's mad. His tongue is thick; his eyes are glazed, and he staggers around in some strange fit——"

But Wacker went. He stepped out under the watching stars in his air suit, and half ran along among the drifts of air snow and around tremendous pylons of ice. He kept his eyes ahead, expecting any moment to see a mighty blast spring from the direction of his laboratory, yet hoping, hoping——

Greeley met him at the inner lock, a disheveled Greeley with an elfin grin on his gaunt, pinched face. He stood swaying before the young scientist, mouth-  
ing broken phrases.

Wacker shook him roughly. "The neutron gun!" he gasped.

Greeley swung an indefinite hand. "It's off, m'boy. But the place is warm. Ah, it's warm for a change. Isn't it splendid, Phil? I wanted to be warm and——"

Wacker dashed to the small but super-powerful machine which flung neutrons through its grid-work target moistened with unstable argon-fluorine transition compounds. He read the dials with a puzzled frown. Enough power had been loosed to blast away the entire target chamber, yet it was intact. And the battery supply was strangely rejuvenated.

Greeley swayed up, leered at the meters. "They lie, don't they, Phil? And I'm crazy. They lie because they



show more gain than loss. A lot more—"

Wacker shook himself from a stupor. "What does it mean, Greeley?" he whispered. "What does it mean?"

Greeley cackled and mumbled on. Wacker listened intently. At last the old scientist plumped himself wearily into his chair. "You see, Phil, it was there before us all the time. It came to me in a flash, like inspiration. Two neutron beams at a focus, to probe within the atom like a forceps and pick out its treasures. The atomic flame rises at the focus. A hot flame, one that heated this room up easily, defying the outer cold. Atomic sunshine, Phil that—"

"The tantalum?" queried Wacker in an awed voice.

"For the grid," cackled Greeley. "My equations show"—he waved at the papers scattered over the floor, scrawled in large, shaky figures—"that a tantalum grid will release every last iota of energy."

Wacker forced himself to a scientific calm. He fastened the tantalum wire over the copper grid in the target chamber, ran a tiny droplet of compound over the plate and focused several quanta of the twin neutron beam over it. Watching the dials, he saw the power needles arc over like frightened things, to smack against their stays with loud clicks.

"Greeley, you're right! It works and—"

"Yes, Phil. Atomic sunlight. Think of a ship powered by this limitless energy, forging into space, toward the dead sun. It projects two focused neutron beams, titanic ones. It lights an Olympian fire all over the sun's surface. In a century the sun blazes forth again, to give its blessed warmth and sunlight to earth, as it did before it went out!"

Wacker's eyes smoldered suddenly. "And man will no longer be a worm. He will crawl out of the ground, face the stars—live again and know the meaning of everything life has—"

Wacker stopped. Greeley was slumped in his chair, head lolling forward. In alarm the young scientist shook him, and took note for the first time of the peculiar odor about him. After a moment the old scientist looked up with bleary eyes.

"Ah, warm, warm!" he mumbled. He took a gulp of liquid from a beaker. "We'll have sunlight, yes. But before that I have moonshine. Y'know, Phil, right after you left I remembered what it was my grandfather said was in moonshine—alcohol. It warmed me inside, like he said it would. It warmed my old brain and heart, too. Gave me inspiration, courage. Moonshine, sunlight—warm, warm—"



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# Gravity, Unaffected

*Fire has its noninflammables—electricity  
its insulators—gravity—?*

by Stanton A. Coblentz

AS I GAZE out through the thick glass windows of the steel shell that is hurling me through vacancy, I know that I shall never set foot on the earth again. Already the dreadful cold of outer space is commencing to seep in through the walls of my flying prison; already I begin to feel the numbness that must precede the end. Yet I experience neither regret nor sorrow. I peer down and see the earth spread below me, a huge ball half hidden in cloud and shadow, with dark continents and shining seas staring from amid a purple emptiness more than two hundred thousand miles beneath; I gaze above, and view the pock-marked face of the moon, hideously scarred, furrowed and wrinkled, and I know that before long I shall swing around to see the side of that world never before observed by man.

No, all in all I am content. The great adventure—one of the greatest in the history of science—has not ended as we had planned; the magnificent experiment of Kenneth Blackburn has failed; and I, Alexander Starr, who had never contemplated taking an interplanetary cruise, have been hurled on an adventure that neither I nor any man had foreseen.

Yet I have no quarrel with my fate. These few days have been worth more than years of unexciting life; while for the watchers on earth, who even now are vainly awaiting the return of the

lost explorer, my flight and disappearance will doubtless provide one of the supreme sagas of science.

But let me tell of all that happened, as calmly as I can. Even though no eyes other than my own shall ever scan these words, let me confide the report to the blank paper, so as to keep myself occupied during these last hours, before the cold shall have overwhelmed me, the oxygen have been exhausted, and all that remains shall be an unmeaning shell drifting through an immensity of nothingness—

THE ADVENTURE began as long as fifteen years ago. At that time Kenneth and I were students at college—roommates and chums, and rivals for honors in the engineering department. It was during the year before our graduation; and I remember that we had both recently developed an intense interest in aviation, and would devote interminable discussions to this absorbing subject. We were both concerned, I recall, with the fact that man, for all his seeming conquest of the air, had not really conquered it; we were appalled and shaken by the series of air disasters which were filling the papers at about that time; and we were led to consider the possibility of some new invention which would make the air as safe as the ground.

"You see, in essence the problem is damnably simple," Ken declared one



*In a long glass tube at the top of the machine, blue sparks were flashing—  
not quite like ordinary electric sparks—*

evening, between puffs at a pipe, as he sat far back in his chair and regarded me quizzically with his sparkling gray eyes. "There's only one thing we have to conquer to make aviation as sure and easy as walking. You know what that is, of course?"

"No—I'm afraid not."

"Of course you know! Didn't I tell you it's damnably simple? Gravitation."

"Gravitation?" I laughed. "So all we have to do is to make things fall upward?"

Ken paused long enough to knock the ashes out of his pipe; then turned to me with his long, thin, scholarly face drawn up in a manner to prove that he was not merely joking.

"I mean this, Alec. Heretofore, haven't we taken gravity pretty much for granted? We assume it's the one force that is unalterable, irreversible, the one force that works at all times and under all conditions and can never be checked or counteracted. Why should that be? No other such force is known

in nature. Fire has its noninflammables to halt it; electricity has its insulators; all chemical reactions come to an end; all moving objects are capable of being checked by an equal counterforce. But gravity goes on unaffected forever, no matter what happens. Does this not seem counter to nature's very plan. It would be——"

"You mean to imply then," I jeered, "that Newton's apple needn't have fallen——"

"Not necessarily! It is conceivable that, under the proper conditions, it would have slipped upward, or remained stationary in the air."

"Well, you find the proper conditions, Ken," I returned, with a mocking grimace that was borne back to me by the mirror opposite, "and you'll be a greater man than Newton!"

"By Heaven, if it's not me it'll be some one!" he flung back, with an almost savage confidence, as he furiously took out a wad of tobacco and jammed it into his pipe. "And I don't see why it shouldn't be me as well as any one!"

"No, why not?" I taunted. "That'll give you something to amuse you in your spare hours."

I arose, and was about to leave the room, when Ken followed me and demanded, almost imploringly, while his eyes blazed with a power that made me realize for the first time that here was an individual altogether out of the ordinary: "But don't you see, Alec! For every force there must be a counterforce! For every action there must be an equal and opposite reaction! That is a fundamental law. It must apply to gravity as much as to anything. And, by Jove, if it can be found, I'm going to discover that countergravity—and apply it! You wait and see!"

"All right, old sport—I'm willing to wait a long while!" I returned, flippanantly, and then sauntered out of the room and promptly forgot the matter.

BUT KEN did not forget it. That fact was to become apparent after the passage of a long period of time. During the interval I was not to see a great deal of my old chum; we had both graduated and gone our separate ways. He had been hard at work with a bridge construction company, while I had been out West helping to plan a new railroad through the Rockies. Seven years had passed when I came back to our home town—and then I found a Ken that was greatly changed. He was thinner than of old, and seemed to have aged fifteen years; his manner was furtive and nervous; his eyes had taken on a wistful, almost haunted expression; he impressed me for all the world as a man obsessed.

During the first evening, I could not get at the root of the trouble that seemed to have so strangely altered him; but I observed that he lacked the old enthusiasm in discussion; that it was as if something unspoken lurked in the back of his mind, overshadowing all that he said.

"What's the matter with Ken?" I asked others of our old set.

They all shook their heads rather sadly and replied with a unanimous, "Don't know."

"He's been rather queer for a long while," remarked Phil Daly, one of our former intimates. "Doesn't come out to meet the boys any more, just shuts himself up day and night, locks the doors, and won't let you in though you hammer as if all hell was there."

"What do you think it is?" I demanded. "Disappointed in love?"

"No—doubt if he ever looked at a woman. But I've gone by his place at two and three in the morning and seen the lights burning behind drawn blinds. Not once, but many times. Wish to heaven I knew what was eating away at his mind!"

"Wish I knew!" I echoed, not realizing how soon my desire was to be gratified.



IT WAS only a few days later when Ken took me aside, blinked a little shamefacedly, coughed in an embarrassed way, like one about to make a confession, and then surprisingly declared: "Alec, I suppose you wonder what the devil's come over me. I know I'm a good deal changed. Well, who wouldn't be if he saw the world turning upside down before his very eyes?"

"The world turning upside down?" I repeated.

"Exactly. I'm going to take you into my confidence, Alec. The other boys—I'm afraid they mightn't exactly understand. They'd think I'd gone nuts. But you—well, it's always been different between us two."

I fear that the tense, uneasy way I peered at Ken revealed something of the dread within me—my dread for my old chum's sanity. It was evident, moreover, that he had caught the trend of my thoughts, for he laughed, suddenly and sharply, ran a gaunt hand over a forehead where the hair was already beginning to thin, and exclaimed, "Well, guess it does look as if I'd gone mad. But wait till you see! Wait till you see! Come!"

Without another word, he started off; and neither of us spoke until we were clambering up the stairs to the attic where he made his home.

"I suppose you want to know how I've been living, Alec," he broke the silence, as his keys rattled in his hand. "Well, believe it or not, you're the first visitor I've admitted in five years."

His hand turned on the doorknob and he plunged inside. But his first visitor in five years halted on the threshold, bewildered and amazed. Was this a man's residence that I viewed—or a laboratory? True, there was a cot tucked away in a corner, side by side with something that looked like a clothes rack. But, apart from this, I seemed to see little but vials, bottles and machinery. The sides of the room were

lined with shelves, which were crowded with flasks and jars of all sizes, many with old, soiled labels; the center of the room was taken up with a laboratory table, and with a huge black engine with a baffling array of wires and wheels; in one corner was a pile of great leather tomes, many of them broken-backed with age; while an electric motor, which almost blocked the doorway, came near to tripping me as I entered.

"Good Lord, Ken!" I exclaimed, as I inhaled an atmosphere in which the fumes of sulphur mingled with various nitric compounds. "Do you mean to say this is where you live?"

"Yes, why not?" he returned, with perfect composure. "A man must be prepared to make some sacrifice for the sake of science."

"All very true. But there are limits to——"

"Not when one is daring the unlimited. Just wait, Alec, until you've had a chance to see. Then decide whether the results are not worth seven years—or seventy—of any man's life."

Probably I had never beheld anything more fantastic than that friend of mine at that particular moment—thin, pallid, emaciated, standing beside the monstrous machine beneath the long rows of bottles, yet with a triumphant smile illuminating and beautifying his features, and with his eyes brilliant with a deep, flashing fire that surely betokened genius if it did not indicate madness.

"You remember our talk years ago," he continued, more quietly, when I had taken the laboratory stool that seemed the only available chair. "You recall how I spoke of the possibility of finding a reverse gravity. Now, after years of research, I am on the right road. Do you wish me to demonstrate?"

What could I do but answer with an awed "Yes." I did not know what

miracle I was to witness; but I was all alertness as Ken darted across the room, turned an electric switch, shifted a lever, pulled out a shuttle, and exclaimed, in ill-suppressed excitement, "Just a minute! We'll have her started in just a minute!"

FOR AN INSTANT nothing happened. Then the wheels of the great black machine began to move slowly, with reluctant groans and gratings; and gradually their motion was accelerated, until they swung round in a sort of gray blur and made a racket that I can only compare to the simultaneous operation of half a dozen printing presses. At the same time, in a long glass tube at the top of the machine, blue sparks were flashing—not quite like ordinary electric sparks, but larger and brighter; while several rods within the engine were heated to incandescence, and an uncomfortable warmth began to fill the room.

Fascinated, yet alarmed, I could only remain rooted there, gazing at that grim contrivance. The din was such that conversation would have been impossible even if Ken, with eyes glued upon his handiwork, had not been darting hither and thither with an almost fanatical frenzy, first pressing a button, then pulling a knob, then turning a dial, as if he were needed at several places at the same time.

It could not have been more than five minutes before he shifted a switch marked "Stop!" and the whole infernal contraption gave a shudder and a groan and the wheels gradually jarred to a halt.

"What in thunder is it all about, Ken?" I asked, as soon as the noise had begun to die away. But, not seeming to hear me, he reached down and pulled a little disk of reddish metal out of a slot near the bottom of the machine.

"Look! Here it is!" he exclaimed, eagerly, holding out the disk for my inspection. "The fruit of years of hard work!"

I tried to appear interested—but never had there been greater sadness in my heart. Here, it seemed to me, was the culminating proof of poor Ken's mental derangement! Doubtless solitude and overwork had twisted his once keen intelligence! For the object that he was displaying—displaying with such joy and enthusiasm—was no more than a thin sheet of some copper alloy, of the size of an ordinary saucer! And he called it the fruit of years of work!

"Now I will demonstrate," he rattled on, eagerly, apparently unconscious of the thoughts that were weighing me down. And he placed the disk on the laboratory table, summoned me to him, and directed, "Here! Put your hand over it!"

Thinking to humor him, I placed my hand carelessly an inch or two above the disk. But instantly my carelessness was gone. The most curious sensation I had ever experienced—a sensation positively uncanny—invaded the muscles of the hand. It was as if the member had lost all weight—no, as if something beneath it were prodding it upward, so that I had the impression that it would have been ready to fly away had it not been safely attached to my arm.

With the instinctive swiftness of one who has touched a live wire, I withdrew my hand. "By the devil, Ken," I cried, beginning to regard him a little more respectfully, "what are you trying to do to me?"

"Oh, don't be afraid." He laughed. "It won't bite you!" And his gray eyes were flashing eagerly, with a sort of triumphant mockery; and about his movements, as I now observed for the first time, there was an assurance and self-command that one would not associate with insanity.

SLOWLY and deliberately, he opened a drawer in the laboratory table, reached for a little flattened, leaden pellet no broader across than the tip of my little finger, and thrust the object into my palm. "Now take note!" he said. "Solid lead, isn't it, Alec?"

"Seems to be," I acknowledged, wondering what he could be about. "But what connection——"

Before I could complete the sentence he had taken the scrap of lead from me and placed it upon the reddish metal disk. And instantly there occurred a phenomenon so strange, so unprecedented, that I could only gape, and rub my eyes, and cry out incredulously.

The lead, apparently of its own volition, had shot in a direct line toward the ceiling, where it remained as if glued!

"See!" remarked Ken, with a happy grimace, as of a magician who delights to mystify his audience. "The Cosmograd in operation!"

"Cosmo what?" I gasped.

"Cosmograd! But don't let that worry you. It's only a name I've given it."

And then, while a satisfied smile flickered across his lean, ascetic face, Ken continued, "We will now proceed to get back our lead pellet."

So saying, he moved the reddish disk a few inches—and there was a thud on the table. He picked up and showed me the bit of lead. "You observe," he explained, "the Cosmograd can take action only on objects directly above it."

Time after time I had Ken repeat the experiment, projecting the leaden particle to the ceiling, and releasing it at will. Time after time, until I had tried my friend's patience to the utmost, I examined the table and the spaces beneath the table, to make sure that there was no concealed machine that flung the lead upward. But as the reddish disk was equally effective when placed on the floor, and even when held in my own hands, I had at last to concede the point.

Ken had achieved the, seemingly impossible! He had discovered a substance that would nullify gravity, a substance that would hurl objects upward with a sort of gravity in reverse!

"How did you do it, man?" Good Lord, how did you do it?" I exclaimed, as, halfway between laughter and shouting, I took his hand in a long, jubilant grasp. "Don't you realize this is the greatest thing since—since Watt invented the steam engine?"

"It will be—when I've perfected it," he admitted, taking my enthusiasm as a matter of course. "You don't think I'm crazy now, do you, Alec?"

"Crazy? By heaven, I'd give half my life to be as crazy myself!" I raved on, as, taking a seat at his side on the cot, I insisted on hearing how he had hit upon the invention—and what he planned to do with it.

"IT TOOK me all of five years to get started," he declared, leaning far forward, with his hands clasped above his knees, and facing me with such a torrent of words that I had difficulty following him. "At first, you see, I was exactly like a blind man groping—trying this chemical and that—acids, bases, salts, metals, everything, without finding so much as a clue. After five years, I was in despair—and no nearer a discovery than when I began. I actually began to feel myself to be like one who tries to square the circle or invent perpetual motion. Then one night, when I lay in bed only half awake, the solution came to me—out of some dark cave of the subconscious, I guess, but so clear-cut that I didn't have even a doubt about it. The cosmic rays! There was the answer!"

"The cosmic rays?" I echoed. "What had they to do with it?"

Ken arose, and with his hands thrust deep into his pocket, began pacing back and forth across the littered floor.

"Everything! Everything! You

know about those mysterious radiations—how their nature and origin is unknown, except that they come to us from outer space, at a speed approximating that of light. Of a sudden it occurred to me—what if they are the results of reverse gravity? What if they are thrown out, from the farthest corners of the universe, by some force that is the opposite of gravity? Since matter and energy have been found to be at root the same, may these rays not have been originally particles of matter, which have been dissociated in the course of ages of flight through space? And may they not be charged with reverse gravity and be able to convey the charge to other objects?

"This was the line of reasoning on which I based all subsequent experiments. It took me a good while to devise a machine that would catch and concentrate the cosmic rays—that black engine over there is my latest in that line—but after a time I solved this phase of the problem, and was actually able to expose a bit of metal to a concentrated attack of the cosmic rays, to a degree far beyond anything ever accomplished before. The results were like magic! In the beginning, I was able to cut the power of gravity in half, in regard to any object placed above the metal—or, rather, the Cosmograd. Later, gravity was nullified; and just recently I developed reverse gravity."

Ken paused; but his long fingers raked his hair in wild agitation. "Wait till I have this perfected," he started again.

But in excitement almost equal to his own, I interrupted. "You mean to say, reverse gravity works without any limit? Suppose that an object charged with this force were to be released in the open air—"

"It would keep on ascending, till it had left the earth's atmosphere or had been withered to ashes by the friction. Its speed would increase as the square

of the distance traveled. I have actually tested all that—again and again—and now I'm sure—"

"But good heavens, Ken! That would provide a new method of aviation, of stratospheric flights, even of interplanetary cruises!"

"Exactly!" my friend acknowledged, nodding gravely. "Of course, there are some problems still to be solved—but I don't mind devoting another few years to the experiment."

AS a matter of fact, nearly eight years more had passed before the invention was perfected. I shall pass over the interval, during which Ken aged more than most men do in twenty years, and became prematurely bald and stooped. I shall only tell of the results of his long martyrdom to science, his years of incessant testing and experimenting. It is now not more than six months since the first announcement of Cosmograd startled the world, not more than six months since that first public flight which caused laymen and scientists alike to sit up with startled eyes, and to admit that there was indeed "something new beneath the sun." A ten-foot cylinder had been prepared, lined on the bottom and sides with Cosmograd—so that ordinary gravity was not only cut off, but reverse gravity was put into effect. This cylinder, held down with ropes and cables so as to prevent it from flying away, was borne to an aviation field not far from New York; committees of scientists were invited to attend, as were newspaper reporters and writers for scientific journals; and after these had had every opportunity to inspect the contrivance, the ropes were cut—and, while the spectators gazed in unbelieving bewilderment, the whole great shining object was seen to shoot cloudward with rapidly increasing speed; and, in less than half a minute, had dwindled to a speck that eluded even the watchers with field glasses. Doubtless it is now sailing

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LIS



the outskirts of the solar system, for no trace of it was ever seen again!

This first cylinder, as every one knows, was empty and carried no living thing; but already Ken was preparing a larger Cosmograd container, capable of lodging a human being. And while the news of the discovery traveled to the ends of the earth, and formed the topic of discussion for scientists in their studies and for laymen from Boston to Bombay, he astonished the world by the announcement that he himself would go up in the next flight.

He did not, however, intend to do anything beyond exploring the upper stratosphere; if there was any thought of interplanetary expeditions, that could wait until further tests had been made. But how, every one asked, did Ken expect to be able to return to earth, once he began shooting heavenward with a speed beyond that of a bullet? The answer, he replied, was simplicity itself, for the Cosmograd did not form the actual bottom and sides of the car, but only an outer covering for a thick steel shell; and he had arranged a series of levers by means of which a man within the car could withdraw the Cosmograd bit by bit, thus gradually counteracting and replacing normal gravity by reverse gravity, and allowing the car to check its flight, to remain stationary in the air, or to return to earth at any desired speed.

On the Fourth of July last, the great flight—which was to represent the crown and culmination of Ken's career—was to take place. The event had been well advertised; the thousands of spectators began to arrive at the aviation field early the night before; and by dawn every available inch was occupied by the milling, excited throngs. Seats in an improvised grand stand had been reserved for famous scientists and the notables of many lands. The President of the United States himself was to attend, along with several members of his cabinet; and, as the time drew near the contemplated departure, one heard the cheering of the multitude, the blaring of bands and the discharge of fireworks, and saw the gayly waving flags and banners that did honor to Ken's invention. Little did any one anticipate that last-minute misfortune which was to frustrate his plans.

WHEN the fact of the fateful mishap became known, and the waiting multitudes were expressing their surprise, disappointment and grief, the disaster was attributed to "chance" and "accident." Yet now, looking back in calm perspective, I wonder whether "chance" is quite the explanation; whether the event could not have been foreseen and prevented; whether, indeed, it was not unpardonable folly to

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YOU  
RISK**

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permit Ken, in his highly excited state of mind, to drive his own automobile the fifty miles to the aviation field—

The flight was scheduled to occur at eleven o'clock; and by ten I was already becoming a little impatient at the fact that Ken had not yet appeared. I fidgeted and tossed in my reserved seat in the grand stand, and took out my watch every three minutes; but not until after ten thirty did I begin to be worried. What could have happened to Ken? Had he not promised me, only the day before, to be on the scene more than an hour in advance? While I wondered, and shifted and twisted uncomfortably in my seat, I was startled to see a messenger approaching down the aisle. In one hand he flapped the yellow envelope of a telegram; while, as he hastened in my direction, I knew with some certainty of intuition that the message was for me—and that it had no good news to convey.

"Seat 48? Mr. Starr? Alexander Starr?" demanded the messenger boy, halting before me.

I mumbled something in reply, seized the telegram and slit open the envelope. But it was as if I had already known the contents. I read:

DICTATING FROM THE BLOOMSDALE HOSPITAL STOP  
 HAD A SLIGHT ACCIDENT STOP  
 RAN OFF THE ROAD STOP  
 RIGHT WRIST SPRAINED STOP  
 LEFT ANKLE BROKEN STOP  
 FOR HEAVEN'S SAKE ALEC TAKE  
 MY PLACE MAKE COSMOGRAD  
 FLIGHT FOR ME STOP  
 YOU KNOW HOW TO RUN THE MACHINE  
 STOP DON'T DISAPPOINT ME  
 KEN

Several times I turned the message over in my hands; several times I reread the words. Then, on an impulse, I arose and dashed out of the grand stand. My heart was heavy, and yet there was something strangely light within me; it was as if I had known all along that I was to take the flight; as if I had de-

sired—no, rather hungered to take it. And, strangely enough, never for one moment did the possibility occur to me of not heeding Ken's appeal.

The audience, when it learned that "Mr. Starr was to make the flight owing to the unfortunate injury to Mr. Blackburn," uttered a few shocked cries and then resigned itself to the substitution. After all, it had come to witness a Cosmograd flight, and not to see a man.

There were, however, tremendous cheers when I appeared on the field and entered the little doorway of the car; and it was amid the din of applauding multitudes that the cables were released and my twelve-foot container, with its sides and bottom of shining red Cosmograd, went hurtling upward with exactly the speed with which a falling object drops to earth.

Oh, those were glorious moments when I found myself darting toward the skies at ever-increasing speed! When I had been gone but a minute or two the earth was already miles beneath, its hills, plains and cities had been flattened into one broad sheet, and the aviation field and the thick black clouds had become invisible—actually invisible! Rapidly the distance increased to scores of miles, to hundreds, to thousands; while I, thanks to the artificial heating system and the oxygen generators, felt little discomfort, only a slight dizziness.

PERHAPS it was due to that dizziness; or perhaps it was because of the sheer mad joy of ascending so swiftly—but not until the whole great ball of the earth shone beneath me, a shining sphere fifty times as broad as the full moon, did it occur to me to check my motion lest I be lost in space. Ken, I knew, had never intended to soar so high; yet I had no fears as I moved the levers that folded up piece after piece of the Cosmograd covering of the car, so allowing gravity to act on the exposed portions. It was but a few minutes be-

fore the speed gauges showed that I was slowing up; and less than an hour before I had struck a neat adjustment, so that gravity acted on half the car, and reverse gravity on the other half—which meant that our vehicle apparently hung motionless in space, neither approaching the earth nor receding.

Apparently, I say, for I should have known better than to suppose that it was possible for any object to remain stationary in space. Yet I so enjoyed the sensation of hanging there in immensity, scores of thousands of miles above the world; I was so absorbed in scientific speculations and calculations that I forgot the most rudimentary caution. The car, I realized, was capable of providing a man with food, heat and oxygen for two weeks—therefore why hasten back to the flat, humdrum earth? And so I planned to allow myself to remain suspended in vacancy for a day or two—and thereby, unwittingly, I sealed my fate.

It was after twenty-four hours that I observed that the moon, whose crater-scarred face stared enormously far above me to the left, appeared perceptibly brighter and nearer. Even then, however, I did not leap to the obvious conclusion. It was only after another twelve hours—when the moon had shifted to my right—that the first sharp realization came to me. The change in position was too great to be accounted for by the satellite's own movement; it must be due to the movement of my space car!

All in one stunning burst of knowledge I understood what had happened! My car, while covered with Cosmograd

on the sides and bottom, had been exposed on top—which means that it had been subject to the moon's gravity! This had been acting long before I had attempted to halt the car in space; and my original motion—which had been at an angle away from the moon—had been so modified by the moon's action as to make the container move in a long ellipse, as a lunar satellite! For all the ages to come it would pursue an orbit around the moon! And now I realized how inevitable—

For a while I struggled frantically against my fate. For a while, by removing the last scrap of Cosmograd from the machine, I tried to call upon the earth's gravity to pull me back. But already it was too late! The moon, at a distance of less than twenty thousand miles, exerted a stronger pull than did the earth at two hundred and twenty thousand. I was caught in the grip of a force beyond my power to resist. The fault, moreover, was wholly mine, since Ken had never contemplated coming close enough to the moon to make it a source of danger.

Yet now, as the end draws near, I am resigned. I am being treated to a spectacle more sublime than man has ever witnessed before; I know that I am the pioneer of the new epoch of space flights. And I shall die content in the knowledge that Ken's magnificent experiment, though it failed, shall be the precursor of other and more successful tests, in which the power of reverse gravity shall bear men safely through the atmosphere and into the stratosphere, and even across the gulfs that separate the worlds.



# PAST, PRESENT and by NAT SCHACHNER

**K**LEON stood on the edge of the jungle, stared out at the bright-blue bay. The great trireme, with its steeply pitched banks of oars, burned furiously. Fire and smoke crackled up to the tropic sun, licked like running tongues around the poop, swirled with final fury over the god Poseidon, whose wooden beard and pointing trident adorned the high-beaked prow.

As the god tottered and fell, charred beyond recognition, into the briny waters, Kleon bowed his head, uttered the classic prayer of Homer. It was an omen, a sign to him that never again would he see his native vines and twisted olive trees, that never again would he discourse with the philosophers or hear the godlike Alexander shout the Macedonian charge against the Persian hosts.

Slowly the embers died, slowly the sound of the crackling timbers ceased. Behind him, framed against a tangle of festooned trees and outlandish blooms, cowered his crew. They were not of his race; they were swart Egyptian sailors from Thebes, impressed by the mighty Alexander for his fleet against Arabia and the Indian potentates.

They held their spears uneasily, bracing themselves against the terrible wrath of their young commander, knowing that they had been guilty of foulest treachery, yet not sorry withal for what they had done. Their eyes feasted hungrily on the women by their sides—whom they had found inhabiting this incredible land where strange stars glowed overhead and the earth teemed with food and shelter and sustenance for the tak-

ing. These women were tall and light and straight, with copper-colored skins and laughing eyes that were a delight to sailors who had seen not even a mermaid for many moons.

Why should they leave these newfound delights, this gentle race of friendly people who called themselves Mayas in their own liquid tongue, to embark once more on restless Oceanus and steer back toward the setting sun? That was tempting the gods too much. This time, they were sure, their bones would molder in the sunless caverns of the fathomless seas, or their ship sweep over the rim of the world into the maw of old Chaos.

No, they had had enough of tempting the spirits of the waters. Only Isis and Osiris had saved them thus far, since the great wind had sprung up in the Indian Ocean and separated them from the fleet of Nearchus, admiral of Alexander, as it skirted the hostile coasts. They would stay here, with the people who thought them and their blond young commander, forsooth, gods from across the sea. Had they not kneeled and worshiped Kleon when the trireme had sailed into the fantastic bay? Had they not cried on him and called him by some outlandish name, as though he had been long expected? Quetzal—that was it.

Yet Kleon, in his Greek obstinacy, had ordered them, after a month of soft surrender to the balmy airs, after replenishment of food and water casks, to the oars again, to brave once more the perils they had so miraculously escaped. His mouth had set in a grim, hard way to all their protestations.

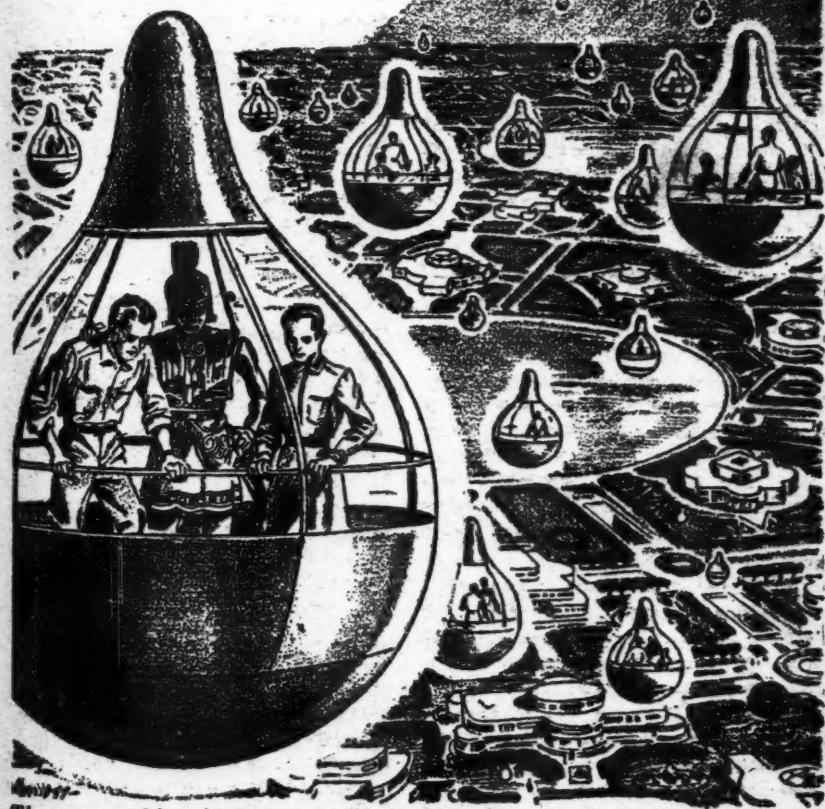
So they had burned the ship! It would



# FUTURE

*The radium poured forth its ceaseless glow—the laminated disk glittered—all was silence—time had ceased—this then, was death—?*

A  
Science  
Novel



*They were skimming over the level about five hundred miles per hour—  
yet there was no motor—no gears—*

be impossible for Kleon, for all his Greek learning, for all the magic arts he had learned among the wizards of the Persians, the Hindus, and the one-eyed Anthropophagi who lurked in caves on the Roof of the World, to force them to breast the waves again.

Yet, because he was their commander and they were but Egyptian slaves, because he wore bright armor and knew how to wield with slashing strokes the Macedonian short sword at his side, they cowered and were uneasy—though they outnumbered him an even hundred to one.

And still the Greek, terrible in his armor like the young sun god, made no move. The trireme was a dead-black hulk on the silent waters. The Mayas, black-haired, tall, stared at the stranger they had hailed as Quetzal, with fixed adoration. Even the raucous birds of many hues, who seemed to mock them from the trees with human cries, were still.

HOTEP, the steersman, approached him timidly. "You are not angry with us, noble Kleon," he pleaded. "We have done only that which seemed best. Here, among these people, we are as gods. Why breast the floods to suffer hunger and thirst and hideous monsters, and perchance, the outraged edges of the world, to return once more to—slavery and back-bending toil and the hewing of fierce weapons?"

Kleon turned slowly. "You have done best for yourselves, no doubt," he said evenly. "You are slaves, Egyptians. You will mingle with these dwellers beyond the flood and find no demeanment in it. You will teach them what you know of the arts and be content. But I am a Greek, and these are barbarians. I will not waste my life among such as these—and you. Life is a precious depository for the *noumena*, the metaphysical thought, or it is nothing. On the farther side of the world mighty Alex-

ander marches to new triumphs, and the Grecian culture marches with him. Here is stagnation, minds that know not science or noble philosophy. What have I, a Greek, to do with these—or with you, for that matter, O Hotep?"

The Egyptian bowed humbly. He was not offended. In the elder days his race had been mighty, but the world had gone topsy-turvy, and the old gods had yielded to new. That was why he and his comrades were content to remain in this new land the balance of their days.

"What do you wish from us, great Kleon?" he asked.

The Greek stared at him speculatively, turned his gaze from the ocean, from the charred husk of the trireme, slid past the trembling crew, past the copper-colored natives, flung inland over the impenetrable jungle to the blue rise of ground that marked the backbone of the interior. Smoke curled lazily from a cone-shaped top. His blue eyes glinted; a strange luster crept into their being. When he spoke he seemed to commune with himself rather than hold conversation with Hotep.

"When Alexander left Persepolis and marched for dreadful months through strange Asian lands and stranger peoples to the Indus, we passed over the very top of the world. There we came upon a race of learned holy men, so old, so wasted with time's attritions, that verily they seemed in sooth what they maintained—survivors from an elder day, when earth was clad in ice and Zeus himself had not been born.

"I spent some time with them, O Hotep, and they opened their minds to me, a curious seeker after knowledge. They told me of the days before the ice came, when the world was young and the bleak hills were covered with strange verdure and mighty cities; they spoke with the air of participants in great civilizations long since buried. In full sooth their knowledge was beyond that of Aristotle himself. They averred that

when the frozen waters pressed inexorably southward from the northern pole their civilization died, but such was the secret science of their priests that some few were able to immure themselves in caverns, there to repose for long centuries in immortal inanition, to awake at a predetermined time when their science taught them the ice would have ebbed back again to the frozen Boreal regions.

"I was skeptical, as the Sophists had taught me to be, but they took me to sealed caverns, into which I was able to peer through a strange instrument that made transparent the solid rock, and behold, I saw some of their sleepers still. These, they averred, had set their awakening for a later era than the rest, desiring to taste the farther future. A thousand more years must elapse before these would stir and breathe again."

"It is incredible," murmured Hotep politely.

THE FACE of Kleon was a contemplative mask. "They taught me the secret," he mused. "The sight of yon mountain, where the Titans rumble underground and the Cyclopes forge their thunderbolts, reminded me of the tale."

He squared his shoulders suddenly. His voice lashed out as it was wont to do when he had led a phalanx into battle. "Hotep, slaves, listen to me!"

They jumped at his clarion tones, forgetful that he was but one and they were an even hundred. "Yes, gracious lord," they chorused.

"You have done a foul deed. You are cattle, and this idle land and idler folk will satisfy your limited desires. But I am a Greek, and must blaze always with a bright, clean flame, or life is valueless. I do not intend to rust away my remaining days among barbarians. Therefore, if you seek my forgiveness, you must follow my will in the exactest degree."

Hotep moved stealthily back to the mass of his comrades, firmed his grip

on his spear. Did the Greek, perchance, have some mad notion of building a new trireme from the heavy forest trees, and blunder toward the west? Rather would he—

Kleon did not seem to see the hostile gestures of his men. "I, too, shall brave the future," he declared. "The present is an empty amphora for my spirit; I wish to fill myself with the bright wine of days that are yet unborn. I shall immure myself in a cavern, even as those priests who inhabited the Roof of the World, and do thus and so as they had taught me. I shall set a time for my awakening—let me see—yea, ten thousand years. Who knows what strange and marvelous visions will greet my eye in that tremendous span of years!"

Spears dropped with dull thuds from nerveless fingers; black beards gaped in ludicrous astonishment, confused voices called on Horus and Ammon-Ra. The copper folk, all unwitting, knowing not the meaning of the god, Quetzal, nevertheless, prostrated themselves in fear before his flashing eye, the sound of his speech that surged like the many-billowed sea.

Hotep burst out in gasping words. "Lord, have you in sooth gone mad? These tales of magic have addled your brain! They but mocked you. It is impossible——"

"It is enough," Kleon broke in sharply, "that I command it." He fingered his sword significantly.

A wave of hasty assent rose like incense from the crew. Why should they not do the mad Greek's bidding? Even so, would they be freed from ever-present dread of their treachery and meditated vengeance. They would live their lives among these gentle folk, take their women for wives, and loll in ease and security after much buffetings. Let the Greek be immured, if he wished, in the bowels of the earth, let him wait for that fantastic future he described.

IT TOOK almost a year to perform the task. But Kleon drove his crew and these pliable folk, who called themselves Mayas, relentlessly. Now that the die was cast, now that he had pondered on it nights and days, he was eager for that future which the gymnosophists of the Roof of the World had promised him; indeed, he was very eager.

He required a volcano; for the gases generated in the smithies of the Cyclopes were necessary for his entombment. He found the blue cone from which the smoke eternally wisped some fifty stadia inland. He caused its base to be cleared, and there the Egyptians built for him a small pyramid, patterned according to the one of Cheops, on which the copper-colored Mayas toiled willingly like submissive beasts of burden. Underneath the tapering stone they inclosed a chamber, rough-hewn, built against the millenniums, air-sealed against all outer contamination. From the chamber they led vents of stone to the bowels of the fire-breathing mountain, so that, by ingenious tappets, the swirling gases of brimstone and sulphurous pungency might be inducted in due proportions.

Then they withdrew and Kleon busied himself in secret. From his leather jerkin underneath the armor he drew a leaden globule. This had been given him by the gymnosophists with appropriate instructions. Within its hollow shell was a lustrous, ever-burning substance—a substance that burned, yet consumed itself only after thousands and thousands of years.

Kleon handled the pellet gingerly, prepared its mechanism so that, at a pressure, tiny openings would appear, so regulated as to emit the radiations of the interior element in specified amounts, and cease completely after ten thousand years. He, a Greek, of course, did not know that he held in his hand an ounce of pure, elemental radium, the secret of whose isolation from its salts had been known to that preglacial civilization, and

had been since lost to the new-born world.

Then, as he had been taught, he arranged a comfortable niche in which to spread himself, saw to it that certain hinged stones devised by Hotep fell swiftly and smoothly into place on swinging pivots to cut off all entrance and exit, placed over a secret spring that controlled the pivots a tiny disk of laminated, fluorescent substance, likewise furnished by the ancients from the Roof of the World. On this was trained the perforations from the pellet of radium.

The potent radiations from the sacred element, they told him, would disintegrate each lamination of the disk in exactly one thousand years. Therefore, Kleon peeled off the excess layers and left but ten to withstand the steady buffets of the radium. As the bombardment finally pierced the last fluorescent layer, the unobstructed rays would then impinge on the naked spring that actuated the mechanism of the pivoting stones. They would turn smoothly in their sockets; air would rush in from outer vents, whiff away the preservative gases, and he, Kleon, would then awake as though from a short, dreamless nap, ten thousand years into the future.

They had tried to explain to him the exact interaction of pure, elemental radium with the special mixture of sulphurous oxides, hydrochloric acid, sulphocyanides and hydrocarbons of which volcanic gases are compounded, but chemistry was not a science of which the Greeks had any knowledge. It was sufficient for Kleon that the products of the interaction had certain effects on body tissues and organs. They acted as an arrester of vital processes, a bath in which all life remained suspended indefinitely with blood uncongealed and flesh both fresh and firm.

AT LAST the day arrived. Kleon felt his heart beat unduly fast. Suppose the gymnosophists had been but playing



on his Greek credulity, suppose they were magicians whose feats were illusions; suppose, instead, he would die within this tomb and never emerge. He laughed, and the sound of his laughter was hollow in his ears. He did not fear death, yet—

They were within the pyramid, within the sacred chamber—only Hotep and he. Outside, guarding the entrance, was his crew, spears uplifted in reverence in accordance with his strict instructions. Beyond, covering the cleared space around the pyramid, flat on their faces in adoration, lay the Mayas. Quetzal, the blond white god, it had been announced to them, intended to sleep. He was weary of the wickedness of the world. But some day, refreshed, mighty, he would arise and bring to his children, the Mayas, eternal life, peace and unexampled prosperity.

"I think," Kleon told Hotep with a grim smile, "that will be sufficient to protect me from harm." He looked shrewdly at the Egyptian. "I think also," he continued, "that you will find it profitable to perpetuate the legend."

Hotep grinned slyly in his beard. "You have an all-penetrating eye, noble Kleon. I shall make myself high priest of Quetzal, and my children after me."

"I didn't doubt it," Kleon commented dryly. Then his face became an expressionless mask. He tested the vents, the ensembling stone. "It is time, O Hotep. Do you retire and swing the stone into place behind you. Then, as you value your life and the honor of your approaching priesthood, seek no more entrance to my abode."

The Egyptian struggled for utterance in his black beard, bowed suddenly, and retired. The huge, rough-hewn stone clicked softly into place. The chamber was sealed.

Kleon, as one already dead, went about his preparations. A smoky torch was all his illumination. The laminated disk swung into position over the spring.

AST—5

The lead pellet fitted snugly into its niche. A touch of the mechanism and infinitesimal holes in the lead trained on the disk. A curious stream of radiance leaped out into the chamber. The fluorescent material of the ten-laminated disk glowed with a fiery bombardment. Kleon felt a strange tingling of his skin, as though innumerable atoms were popping into oblivion. He had been warned against the deadly effects of the unobstructed radium.

Half aghast at what he was about to do, he completed his preparations. Very carefully he laid himself down on his prepared pallet, hewn out of the solid wall, stretched himself out. By his side he laid his sword, and a keen-edged javelin. He was a fighting man, a leader of a phalanx. Who knew what manner of men he might meet in that remote, unimaginable future. In a corner of the chamber were sealed potteries, filled with dried food and water against his hunger and thirst on awakening.

He grimaced. Would he indeed awaken? His sinewy fingers held on the tiny metal lever at his side. A downward pressure and the smooth-shaped stones that sealed the vents from the volcano would open. After that—

The torch flickered smokily. Soon it would go out. The air in the inclosure was being fast used up. Breathing was becoming laborious. The stream of fiery radiance across the gloom seemed timeless; the disk pricked out in pin points of flame. The dry tingling of his skin increased. He gritted his teeth, swung down on the lever.

Three great stones moved noiselessly on their sockets; three smooth holes appeared suddenly in the wall. There was a faint rumble; a sucking sound. Gas billowed in, thick, yellow.

It swarmed through the underground chamber with clammy, twining tentacles. It beat around his head with acrid, suffocating vapors. The torch flickered, plunged into darkness. His body

twitched; his lungs labored for air. The gas sucked in, stung and smarted.

But already a faint luminescence glimmered through the yellow, clogging surge. It spread. Fireflies glittered and danced. There was a crackling sound, new pungent odors. Chemical transformations beyond his knowledge were taking place.

Kleon felt a sudden release from the burning sensations. He tried to breathe, couldn't. He tried to move his limbs. They refused all action. The pounding of his heart slowed, died. A vast drowsiness assailed him. He was slipping. Time slipped with him.

This, then, was death. The chamber revolved slowly around him. His thoughts drifted through soft obstructions. Never again would he see his native vines, his gnarled olives—Athens—Alexander—comrades—

The chamber underneath the pyramid was very still. The vents to the volcano had closed automatically. The transformed gases laved the motionless body in their bath of inanition. The radium poured forth its ceaseless glow. The laminated disk glittered under the impact. All was silence. Time had ceased—

## II.

SAM WARD wiped the sweat from the palms of his hands along the rough khaki of his trousers, and stared. He was tired, perspiring, bitten by stinging insects, broiled by the hot Guatemalan sun, and more than a bit disappointed. He had been led to expect more.

"There eet ees," the half-breed Indian pointed his grimy finger with half-triumphant, half-fearful gesture. "Juan nevaire lies. Now señor will pay heem the fifty dollars Mex he promise. Juan do not weesh to stay. There ees dangaire."

Sam did not answer. He took in the scene with practiced eyes. It was a find, all right, but there were innumerable

higher and more elaborate ruins within the Yucatan Peninsula. There would be nothing here of startling importance.

Sam had done many things in the few years since he had left college. China and the war lords, diggings in the Mesopotamia coupled with certain unheralded brushes with the Bedouins, an unregulated, unauthorized stay with the Harvard excavations at Chichen-Itza in Yucatan. Then, finally, this comparatively tame, but well-paid assignment to investigate the inner jungles of Guatemala for possibilities of banana plantations on behalf of a New York syndicate.

At San Felipe, off the Pacific Coast, he had met Juan. A dirtier, frowsier, more drink-sodden half-breed did not exist. But Sam found him almost his sole source of information.

The whites were courteous, but vague. They shrugged expressive shoulders. The steamy jungles that rolled interminably inland up to the gaunt ramparts of the Sierra Madre were places most assuredly not to be visited. They were impenetrable, malarial, full of ticks and yellow fever, quaking with bottomless bogs, inhabited only by poisonous snakes and fierce animals, and, said his informants expressively, the Indians would not like it.

Sam Ward grinned at this latter bit of news. He felt perfectly competent to take care of himself. He was tall, broad-shouldered, with lean, hard muscles that rippled smoothly as he walked. He had been in jungles before, and he had faced men wilder than any beast or snake. A holster flapped carelessly at his side, and it housed a six-chambered revolver. It was fully loaded and Sam had used it with effect and deadly accuracy on certain necessary occasions. There were more bullets in his cartridge belt. No, Sam Ward did not much worry about the dislike of the Indians. He had a job to do for which his

employers had paid liberally, and it would be done.

"But why," he asked carefully, "would the Indians not like it?"

His informant shrugged again. He was the mayor of San Felipe, short, stout, and a trifle asthmatic. "They do not tell, señor," he acknowledged. "They are Mayas, descendants of a stiff-necked race. Those jungles are sacred to them. There have been men gone in there, señor, but they never come out. So——"

Sam tried the Indians. They were tall and straight and handsome, in a copper-colored way. No, señor! They would not guide him into the jungle, not even for twenty dollars Mex. Why? The god Quetzal would not like it; he was asleep, biding his time.

IT WAS then he found Juan, out-cast from white and red alike, vainly trying to cadge another drink of the fiery *tequila* from a flinty-hearted tavern keeper. Sam set him up, promised more, *mucho* more, for guidance into the forbidden territory. Juan babbled confusedly in terror, but yielded after a few more drinks skillfully applied.

Then came hours of hacking through thorny jungles, hours of slogging through bogs and fighting ticks and mosquitos. It was a hell hole. Yet there were certain areas where the trees might be planted, if only the natives could be cajoled into work. A gamble any way you looked at it, Sam thought. He was ready to turn back.

Juan saw his gesture of disappointment. He thought fast. He knew how these fool Americans paid generously to be shown bits of stone in the jungle. His drink-colored brain had lost all fear.

"Maybe I show the gracious señor where Quetzal he sleep? Maybe eet ees worth fifty dollars Mex, huh, señor?" he said hopefully.

Sam pricked up his ears. "Quetzal? Nonsense! Every guttersnipe in Central America will show you where that

fabulous god sleeps, for a consideration. I've seen enough unnecessary stones in Yucatan to last me a lifetime. Besides, the old Mayas built no cities on the Pacific side."

"Thees ees different," Juan persisted. He had noted joyfully that there had been no objection to the fifty dollars, and in his greed he lost all sense of superstitious fear. "Thees—what you call it—real theeng. I listen once to priests making talk in time of full moon."

Sam considered. The Sierra Madre loomed jagged and high a bare half dozen miles farther east. A smooth, symmetrical cone plumed lazy smoke into the air, tiredly, as though it had been doing so for incredible ages.

"Done!" Sam decided suddenly. Bananas had not worked out very well. Perhaps archaeology might. Another Chichen-Itza? "But remember—no Quetzal, no money."

And now he stood, disappointed, staring at the smooth flanks of the volcano, and at the half overgrown, very low, plain pyramid that was almost lost in its shade. Mayan ruins, no doubt, and in a virgin territory. But he had seen hundreds of similar ruins which had yielded nothing of particular importance.

"Quetzal in there," Juan insisted. "Please, señor, geeve me the fifty dollars Mex and let Juan go queekly. Quetzal maybe get angry."

Sam shook his head. "No sale," he grunted. "Show me Quetzal and I'll double it."

But he was talking to thin air. For the half-breed had swung suddenly on his bare heel, let out a startled yell, and dived headlong into the tangled jungles that inclosed them.

"Here, what the devil!" Sam cried and jerked at his gun.

Then he stopped, and his mouth set in a grim gash. He had seen certain gliding forms slip noiselessly through the thorn bushes and vanish. Mayas! They had been on his trail for hours,

dogging his crashing progress through the jungle. Juan, he decided, would never get back to San Felipe. The odds were against Sam Ward's return, either, he thought quietly.

Slowly, he backed up to the overgrown pyramid, gun trained for the slightest movement in the encompassing jungle. There was none. If he could climb the ruin's crumbling, vegetation-covered slopes, he might be able to orient himself, find a way through the trackless forests.

His foot caught in a depression; he stumbled. He jerked around, nerves tense. There, at the base of the slope, practically screened from view by a mat of creepers, was a black hole. His foot had crashed through the tough lianas, burst them asunder.

STILL WARY, expecting every moment to hear the whistle of a blowpipe dart through the air, he bent to examine it. Luckily, he had a flashlight. He sprayed it down. The questing light illuminated a passage, steeply slanting, straight, stretching fathomlessly.

Feverishly, Sam clawed away the remaining creepers. He forgot even the lurking Mayas, waiting to slay this invader of their ancient secrets. Maybe the drunken half-breed had been right, after all. For this passage was squared by human hands, and in a fashion different from those of the Yucatan pyramids. Vague familiarity tugged at his brain, exploded into sudden knowledge. He had seen passages just like this in Egypt, at the Great Pyramid of Cheops.

He knelt, sniffed at the air. It was cold and dank with the must of the underground, but it was breathable. He took a swift glance backward. There was not a rustle in the jungle, not even a bird cry. He smiled grimly. The Mayas were waiting patiently. Time was of no particular value to them. Well, let them wait. He also had plenty of time to die.

Meanwhile, the pyramid tugged at him, flooded him with eagerness. Its very shape, overgrown as it was, showed Egyptian influences. If he could prove that thesis, then the whole problem of the Mayas might be solved. If! He laughed harshly. He had no illusions. The chances of his breaking through to San Felipe were mighty slim. Then he shrugged, even as the mayor had shrugged, even as a certain Kleon had shrugged over two millenniums before. His life was in the lap of the gods. In the meantime—

He ducked quietly into the passageway. Rocks and loose dirt slithered in after him. The echoes were like muffled thunder. Carefully, he picked his way along, always down, spraying the flash before him. The walls were rough-hewn, but neatly jointed, bare of all carving. It was cold and the air somewhat foul. Which meant that there was no other exit to the tunnel to create a ventilating draft.

Down, down he went, cautiously, watchful. Behind him were the Mayas, resentful of his desecration of their secrets; before him was—what?

He found out fast enough. He was staring blankly at a solid, barring wall. The tunnel had ended abruptly. He flashed his light carefully over its surface, and his heart leaped. Very faintly, almost smudged by obliterating time, he noted thin, straight cracks. A final capping stone had been heaved into position, incredible ages before. That meant there was a chamber within, sealed by long-forgotten men.

Juan had talked of Quetzal. So had the frowning Mayas. That, of course, was ridiculous. Quetzal was a myth, like—like—Zeus and Poseidon and all the Greek Pantheon.

Nevertheless, he must get in, even if he never lived to disclose to the world what he had found. But how? The great stone must weigh over a ton, and there was no way even to get a finger-



hold in that thin line of division. It would require patient drilling with high-powered drills. He laughed at that. He might as well as ask for the moon.

Then his eyes narrowed. There had been tales, in Egypt, of cunning artifices, of secret springs that moved stones smoothly. He had never seen one, nor had any one else with whom he had talked. Always it was some vague other, third or fourth removed from the narrator, who had vouched for such finds.

Nevertheless, his sensitive fingers strayed and tapped and probed. With a lit of exultation he edged a forefinger into a tiny, shallow concavity, discernible only to pressure, not to sight. He jabbed.

THE WALL seemed to disappear smoothly in front of him. He had not even seen the great stone turn on its pivoting axis. Light glowed beyond.

He jerked through the opening, swung his flash eagerly around. A short exclamation throttled his throat, died queerly on his lips. He was in a rough-hewn chamber, walled with blocks of solid stone. A strange radiance streamed from a tiny niche in the opposite wall, danced past him in a direct beam toward the way he had entered. This was in itself exciting enough. But in the farther corner, dimly illuminated by the queer, crackling luminance, ensconced in a recess carved out of the solid rock, a figure stretched motionless.

Dead, of course, but queerly lifelike, queerly fresh and untouched by the countless years of immurement. He seemed as if he were merely asleep, awaiting some last trump.

Sam pressed forward. His limbs were strangely sluggish, his breathing heavy. There was a curious yellow smoke within the chamber, glowing with an inner light, that stirred clammily about him. Sam paid no attention, attributing his thudding heart to the excitement of his find.

For the man on that bed of rock was blond of hair and white of skin. His features, composed in the embalment of death, were regular, classical, as if chiseled on a medallion. Armor incased his limbs, still untarnished, still bright.

Unbidden, wild theories flashed through Sam. This was no swarthy Maya chieftain. This was—Quetzal? The legend of that bright, blond god who had come out of the Pacific, blue-eyed, bringing civilization to the Mayas. Could it possibly be—

Then, and then only, did Sam Ward feel the choking sensation in his throat, the nightmare clogging of his limbs, the electric prickling of his skin. The gas! An embalming gas, whose secret had been lost in the mists of time, whose preservative influence was doubtless responsible for the incredible condition of the blond-haired mummy. He must get out quickly—give it a chance to dissipate—

The cry that welled from his lips was strangely thin. The pivoted stone through which he had come had disappeared. In its place was a solid, blank-seeming wall. He had not heard it close behind him. Yet he could have sworn there had been a guttural chuckle, the stealthy pad of naked feet. The Mayas had crawled soundlessly after him, had immured him for all eternity!

He stared at the fluorescent disk that glowed uncannily on the stone. His thought processes were becoming curiously fogged. He tried to laugh. The sound was dull, far-off. Irony! He had made the greatest find of modern times, and he could not shout it from the housetops. Quetzal had taken his revenge. Perhaps, in some future time, remote archæologists would break into this chamber, find an incredible sight. A fair-haired god in bright armor—and another mummy, dressed in rough khaki, obviously of the twentieth century. He could envisage their bewilderment, their learned explanations.

The flash dropped from his paralyzed fingers; his limbs swayed pendulously. He tried to breathe, couldn't. His heart no longer pounded. He was floating on a huge, yellow sea. His brain fought on a moment, failed. He fell, sprawled out on his back.

The flash sent its aimless beam along the stone floor, died out eventually. But the glow from the leaden pellet persisted, as it had for more than two thousand years before. Time ticked on wearily in the outside world. Civilizations rose and fell; wars decimated the earth; incredible events took place.

But within the chamber silence reigned and the radium clock burned on with ceaseless energy. Two figures lay, side by side, motionless, untouched. Outside, storm and sun and air-carried seeds built up over the low pyramid layer on layer of soil. The Mayas were forgotten. The last priest, descendant of one Hotep, prayed for the last time with bleared, hopeless eyes. Juan rotted into mother earth, a tiny poisoned dart between his shoulder blades. Sam Ward, too, was forgotten. For a few weeks there had been a flurry in San Felipe. But the search was half hearted, and there was no way to determine where he had been lost in the jungle.

Kleon—a Greek—and Sam Ward—an American—heirs of different ages, united eternally in subterranean death, while the world wagged on to a fantastic future!

### III.

TOMSON was curiously near to the vulgar emotion of anger as he stepped into the conveyor tube that would drop him to the lowest subterranean level of Hispan. He did not like to leave his cubicle on the middle level. There was home, his laboratory, his equipment, his calculation chamber. The atmospheric pressure was carefully attuned to his delicate body; the temperature did not vary by a hundredth of a

degree from the warmth that was best adapted to the efficient working of his mind. In all the fifty years of his life he had not stirred more than half a dozen times from his level, and never this far down to the lowermost diggings of the Worker caste.

Why should he? He held his ordered niche in the system of Hispan. It had been fixed from birth, was comfortable, unalterable. Any other mode of existence was inconceivable. There had always been Olgarchs, there would always be the need for his class, the Technicians; and as for the Workers—well, no one paid much attention to them. They worked out their lives in the bowels of the earth, tended the mighty machines that made Hispan possible, dug and bred and died in humble anonymity.

Tomson dropped steadily down the conveyor tube that ran the vertical length of Hispan. A field of force hummed always in the tube. Travelers regulated the speed of ascent or descent by resistor packs attached to their belts. A slight shift to the right or left of the rheostat lever and positive or negative resistance to the field of force built up quickly in the required degree, and determined the speed and direction of flight.

Tomson passed the secondary levels of the lesser Technicians and his bald, bulging forehead wrinkled. It had been Harri who had respectfully but insistently begged his presence in the subterranean diggings. Damn the fellow, with his twitching face and excitable gesticulations of hands and legs. Why couldn't he have handled this alleged new situation himself and not have disturbed Tomson's intellectual concentrations? Didn't he know how highly organized and easily disrupted the delicate body and brain case of a chief Technician was? Down here in the Worker levels were crude pressures, fit only for hulking creatures, and temperatures that fluctuated by as much as a whole degree either way.

He shivered as he dropped, was tempted to return to his quarters and let Harri struggle with the problem himself. But Harri was obviously floundering, frightened even; and if anything went wrong the Olgarchs would hold him, Tomson, responsible. He sighed, and sped up the tempo of his fall.

The levels flashed by with clicking signals, tier on tier of them. Each one held its ordered niche in the society of Hispan. He had passed the ten sections of the lesser Technicians, dropped through the storage levels, the incubator tiers, the subsidiary power units; then he fled past the myriad swarming cells of the Workers, down through the factories

where the food pellets were synthesized, past the levels of the intricate machines, and the eternal flames of the atom crushers.

There were others rising and descending in the force field of the conveyor tube. All greeted him as he flashed by, some with the decent nods of equals, others with respectful salutations in nice gradations of humbleness according to the level of abode. He returned them with the proper bend of head and twist of hand—and suddenly bent his slight form almost double.

A YOUNG MAN had just stepped out on the platform of the Workers' cat-



*Within the corner of the immuring chamber he saw the shadow of a pellet—metallic radium, its atoms breaking down—*

ing level, twisted his resistor pack, was rising in the conveyor tube. He was tall and well-formed, not spindly and bulging of forehead as Tomson, nor clumsily heavy as the Workers. He moved with a quick, calm grace, and his tawny hair was almost radiant. His features were aristocratic, high-bred, and were saved from superciliousness only by a frank, careless smile which he flashed on Workers, Technicians and equals alike, much to the scandal of his fellow Olgarchs.

He returned Tomson's respectful genuflection with the same grin, and was gone, a tawny portent, flashing upward to the highest Olgarchic tier. Tomson straightened out, so startled that he forgot the proper meticulous nod to the next Worker who humbly saluted him.

What was Beltan, an Olgarch, doing in the Worker levels? It was not, of course, the province of a Technician, even a chief, to question the goings and comings of the Olgarchs; but very rarely, and only for serious reasons, did any of the ruling caste deign to leave their parks and palaces. Tomson realized that Beltan was different from his fellows. With the others, like Gano, the dark, saturnine head, he knew his place and was at ease. Not so with Beltan.

The yellow-haired young Olgarch was forever poking his nose into nooks and corners of all the levels, had sought certain technical and scientific information from Tomson about which his fellows had never bothered, had actually, on occasion, spoken to a Worker. This in itself was an unheard-of thing, and Tomson disapproved of it strongly. Let each man order his actions in conformity with custom and station—even an Olgarch.

The bottom of the great shaft shot up to meet the Technician. In his bemusement he had barely time to switch the lever and come to a floating halt. He had reached the end of his three-thousand-foot drop.

He shivered, drew his scanty garment

close around his thin shoulders. He coughed slightly. His sensitive skin detected the unforgivable variation of temperature in these depths. Why, it was surely a degree and a half below blood heat, the equable bath in which his body was wholly at ease.

Harri was waiting for him at the bottom of the conveyor tube. His sharp-nosed features betrayed his mingled anxiety and relief at the sight of the chief Technician. Now all responsibility was lifted from his own shoulders. Harri, like all lesser Technicians, was able to sustain only a minimum of such an onerous commodity as independent thought and action. He was of the caste who contacted the Workers directly, engineered their operations, directed their activities. They were the administrative branch, whereas the chief Technicians performed executive duties only; planned, experimented, made scientific discoveries.

"What is the meaning of this?" Tomson asked sharply. "Must a chief be disturbed from his important meditations simply because you are too lazy to think your problem out?"

HARRI suffered from a nervous tic. A good many Technicians of both classes were thus afflicted. The neural system was overdeveloped compared to the muscular and vascular supports. His nearsighted eyes blinked rapidly; his arms and legs jerked uncontrollably. "I am sorry, Tomson," he declared humbly, "for breaking in upon your meditations. But a situation has arisen. You see, you gave instructions for a crew of Workers to blast new areas from the underlying rock. I was placed in charge."

"I know—I know!" Tomson grumbled impatiently. "We need more fuel for the atom crushers. Get on with your story."

"It is simply this, Tomson," Harri hurried. "In accordance with proper



procedure, I turned on the penetro ray before I gave the order to blast. It sometimes happens there are materials embedded in the rock stratum we could otherwise use. I declare, my heart almost ceased its necessary functions at what the ray disclosed. I stopped all work, hastened to contact you at once. This represents a problem not in my sphere of action."

"What," demanded Tomson, "did you see that scared you into the loss of all faculties?"

"You shall determine for yourself. Look!"

They were standing below the lowermost level. During the course of thousands of years, as Hispan required more and more power for its purpose, the solid rock that underlay the city had gradually been penetrated to greater and greater depths. The rock was blasted with shattering electro-dissonances, the resulting powder fed into the atom crushers, and there, in shielded furnaces, the electrons burst from the atom shells, flashed into annihilation, and furnished energy for all the mighty machines that powered the city.

Within the still unfinished cavern, blasted from glistening quartzite, stood twoscore Workers. They were powerful, husky men, towering over the intellectualized Technicians, and their bodies were knotted and twisted with muscles. They stood by the boring machines and blasters, immobile, waiting patiently for the end of the conference of their chiefs. If they waited for hours it did not matter. Nothing mattered. It was all routine. They worked their shift, and they returned to the eating level, ate their pellets in silence in long community barracks, shifted to the matting quarters, performed their necessary acts, ascended next to the recreation level, where, for a few precious hours, they talked, quarreled, jested, saw selected audio visions of innocuous com-

edy at which they roared unthinkingly, and, by signal, shifted to the final sleeping unit, there to be awakened by further signal to continue the endless round.

Harri's finger jittered toward the control mechanism of the penetro ray, switched it on. The machine hummed with blue light. The solid rock seemed to dissolve in front of it, to become transparent as the clearest glass. Tomson stared, started violently in spite of himself. It was not proper for a chief Technician to show vulgar surprise in front of inferiors.

The vague outlines of a mathematical pyramid glimmered beneath, surrounded by encrusting pressure strata. Within its tapering body a passage showed, clogged with sediment and crumbled stone. At the farther end it opened into a shadowy chamber. He stepped quickly forward, adjusted the depth of the ray to bring its contents into bold relief.

TWO BODIES lay sprawled—one outstretched within a niche, clad in shining metal, the other twisted on the stony floor as if he had fallen unawares. Neither was a man of Hispan, in lineaments or dress. They seemed strangers from another world—preserved in every detail as if they had just fallen asleep, yet obviously dead. A yellowish gas, slightly iridescent, filled the chamber.

Tomson wrinkled his vestigial nose. The delicate instrument next to the ray apparatus was fluctuating violently. Powerful radiations were filtering through the layers of rock. He permitted himself a most unseemly exclamation of astonishment. Within a corner of the immuring chamber he saw the shadow of a pellet, through whose eyelets thin shafts of radiance were streaming. Metallic radium, its atoms breaking down through countless centuries, emitting ceaseless packets of alpha, beta and gamma rays!

"What shall we do?" Harri asked worriedly.

For the moment Tomson's shoulders sagged. He would have wished not to have the responsibility of a decision. Should he call on Gano, head of the Olgarchs, for his orders in this emergency? Then he straightened his frail body. No! This was his province; he must handle it himself.

He tried to keep his voice from quavering as he issued what he thought were crisp commands. "Blast away the outside layers of rock, Harri, then the inner wall of the chamber. But be careful not to harm anything within. We must examine the bodies of these strange beings who have been buried, for who knows how long, under the very foundations of Hispan."

Harri gave orders. The Workers obediently moved into action. The borers hummed and bit through the hard stone like so much melted butter; the blasters whiffed the surrounding layers into impalpable dust, which was instantly sucked into vacuum conveyors and whirled aloft to the atom crushers for conversion into power.

"That's enough." Harri gestured.

The borers stopped, the blasters died, and the last thin layer was gone. The chamber lay exposed to their view.

The thin yellow gas swirled out, dispersed into scattering particles. The air rushed in, laved the silent figures. At a word, a Worker lumbered over to the radium pellet, thrust it into a leaden receptacle, sealed the top. It did not matter if his hand were burned by the deadly radiations in the process.

Harri gulped. His eyes almost bulged out of his head; the skin twitched over his face with rapid jerks. "Look, Tomson," he gasped feebly. "They're alive!"

Tomson felt the perspiration start out on his bald brow, in spite of the fact that the temperature was more than a degree below his accustomed normal. The

Workers looked uneasy. Alarm gaped on their lowering faces. The chief Technician had sufficient presence of mind to order them sharply to their quarters, though their shift had still some time to go. It was unprecedented, but so was the situation in which he found himself.

The Workers went hastily, shuffled into the conveyor tube, lifted swiftly to empty eating quarters, chattering at what they had seen.

Tomson and Harri were left alone to face those risen from the dead.

#### IV.

SAM WARD was the first to return to the interrupted processes of life. He had been under the retardant influences a lesser period than Kleon. As the preservative gases fled, and fresh, clean air took their place, he opened his eyes. He yawned; he stretched unwittingly. He did not know what had happened. It seemed, for the first few seconds, that he had merely aroused from a particularly deep and healthful sleep.

Then he blinked. Was he dreaming? What the devil was this place? Who were those curious creatures who stared at him as if he were a new species of insect? His eye fell on the outstretched figure of the man in armor. The figure was moving, was sitting up!

With an exclamation, awareness flooded Sam. San Felipe, Juan, the jungle, the pyramid, the Mayas, the stumbling into this cave, the entrapment, then—blankness—

He jerked to his feet swiftly. The gun whipped out of its holster, leveled. "All right," he said harshly. "What is this masquerade about?" His question was directed to the two outlandish figures before him. This jungle was spewing forth more and more strange things. They were not Mayas, but neither were they members of any human race he had

ever come across. And those intricate machines that filled the background of the cavern. He was sufficient of a physicist and engineer to realize that they were far in advance of the year 1937.

Tomson shook his head sagely. This was indeed a matter for Gano. His brain clicked keenly. After all, he was a chief Technician. He knew something of the history of the world in the dim days before it died, and Hispan was isolated in a protective film. These were primitives of those earlier eras, somehow immured in this underground chamber, overlaid with the rocky accretions of centuries. The radium pellet, the gas that had dissipated, had kept life intact, though static.

It did not surprise him either that the stranger spoke an archaic variant of the tongue of Hispan. There had been a universal language on earth before it died. As for the curiously fashioned bit of metal in his hand, that was obviously a weapon. Doubtless solid pellets issued from its orifice. He was not afraid. Fear had been bred out of the Technician class. Besides, one touch of the blaster inset at his side, and stranger, weapon and all, would go to feed the energy units of the atom crushers.

"Masquerade?" he repeated slowly. "That is a word I do not know. But you require much explanation—you, your comrade, and this place in which you have laid as one dead. The questioning I shall leave to Gano."

Sam Ward lowered his gun. Surprise at the clipped, curious syllables of this little man with the high, bald forehead and single belted garment of lustrous material gaped his jaw. It was English, in a sense, and understandable, but—

At this instant Kleon rose lithely to his feet, caught up his short Macedonian sword. He seemed like a god among mortals—his fair blond hair, his calm blue eyes that took them all in with one

sweeping glance. This, then, was the future, ten thousand years ahead. The gymnosophists from the Roof of the World had not lied. He was disappointed, a bit contemptuous. Were these the beings of the future? Could a Greek of Alexander's day, steeped in Aristotle and Aeschylus, find meet companionship with these spindly, feeble creatures who stood before him?

THEN his eyes met those of Sam Ward. Ah, this was a different manner of man. He took in, approvingly, the tall, well-shouldered body, the evidence of power and muscular development, the steady gray of eyes, the level brow. Here was a man who could fight as at a frolic—and judge wisely—a healthy mind in a healthy body.

Sam was bewildered. Quetzal had come to life. These others— It was getting damned confusing, nightmarish even. He whirled on Kleon. "And who the devil are you—Quetzal, Maya, or what?"

Kleon stared quietly. This was a language strange to him, a bit barbarous, if the truth must be told, with its harsh consonants and lack of mellifluous vowels. Yet there were two words—Quetzal, Maya. He understood them. Those copper-colored Cimmerians on whose far shore his trireme had been driven had called themselves Mayas, and they had termed him Quetzal, and bowed down in worship.

"Your tongue is unknown to me, my friend of a future that is now," he said calmly. "But I recognize the words Quetzal and Maya. The barbarians called me Quetzal; why, I do not know. But I am Kleon of Athens, who had journeyed far with mighty Alexander, and whose ship had been driven to a strange coast. There was no return; Hotep and the Egyptian slaves burned the ship. It was not meet for a Greek to rust out his life with barbarians. I

therefore availed myself of certain magic taught me by the gymnosophists and slept into the future, hoping then to meet beings fitter to converse with an Athenian. Ten thousand years should have elapsed. I confess I am taken with your presence, stranger, but these two others are beneath my notice. Are they perchance your slaves?"

Sam Ward did not even know he had slid his gun back into its holster. This was becoming entirely too incredible. First two weakling creatures who spoke a distorted English, yet were obviously of an advanced civilization. Now the god in shining armor, risen from the dead, speaking in ancient Greek, avowing matters beyond all possibility. For Sam had studied Greek at college and recognized the long surges, the mighty flow of that noblest of all languages.

He shook his head violently to clear his addled brain. Ten thousand years ahead! That meant eight thousand years for him. Good Lord! Had he slept that long? Were these others representatives of that far-distant future? He opened his mouth to speak, fumbling for the dimly remembered Greek.

But Tomson had decided that enough time had been wasted. He had understood the tongue of the man in the coarse-fibered clothes, but not this other in shining metal.

"Enough," he interrupted peremptorily. "These are matters for Gano, the head of the Olgarchs, to settle. You will come with me."

Sam was slowly regaining his poise. His pulses even leaped at the incredible adventure that was opening its doors to him. "O. K.," he said. "Lead on to this Gano."

But Kleon did not move. He had not followed Tomson's words, but the gesture was unmistakable. He took no orders from a slave.

Sam read his mind and grinned. "It's all right, friend Kleon, alias Quetzal,"

he translated haltingly into Greek. "These men are from that future you told me about. They are not my slaves. I am from another time myself, some two thousand years after you. Sam Ward is my name, and my country America. It did not exist in your day. I stumbled into your pyramid, and slept along with you. I don't think they mean us any harm."

Kleon's face lighted with gladness and a certain astonishment. "You speak Greek, Sam Ward, yet you speak it as a barbarian would. The accents are false and the quantities wrong." Sam grimaced wryly at that. His professors at college had been most careful in inculcating those accents and quantities. They represented the true Attic Greek in all its purity, they had averred.

"As for fear of harm"—Kleon straightened himself proudly, gestured significantly with sword and javelin—"these, my good weapons, are sufficient protection against such puny things as these men of the future."

Sam knew better. He had a hunch that even his own six-chambered revolver, with its fleet spew of death, might not be able to cope with the unimaginable weapons available to the year 10,000 A. D. Brawn, cold steel, meant little in such a case. But, of course, Kleon knew of nothing beyond the sword, the spear and bow.

NEVERTHELESS, they followed the pair. Tomson and Harri, in spite of appearance, radiated a certain power, a certain feeling that it would be wise not to resist. They came to the great conveyor tube. Sam looked up its circular orifice, stretching almost five thousand feet aloft, and wondered. Were they expected to climb those smooth, coldly glowing walls?

Tomson jerked resistor packs from an emergency kit; strapped them on the two strangers. "Do as I do," he said, "and do not fear."



Sam moved the lever over obediently. Kleon understood and followed suit. Sam Ward could not repress a startled cry; Kleon called upon Hermes, the god of swiftness. They were catapulting upward at breath-taking speed.

Sam caught glimpses of a mighty civilization as he fled smoothly up: platforms which led into levels crowded with swarming humanity; huge machines that glowed and blasted and spun and gyrated; endless quarters; glittering miles of strange sights; laboratories; enormous sectors of fiery tumult, tier on tier, until he grew dizzy.

Then, new levels—a different world. Underneath lay teeming life, sprawling vastness, machinery, technique. Here were soft green patches shimmering under dewy artificial luminance; flowers of strange blooms and stranger fragrance; a soft, lapping interior lake, blue as cobalt, warmed and perfumed; multicolored buildings, spaciouly set, gracious with curves and melting outlines; noble figures who gazed through transparent sections at their upward rush with in-curious eyes and returned to their dalliance.

Then, suddenly, the mighty shaft ended. Tomson gestured and switched the lever to neutral. Sam and Kleon did likewise. Harri had quit them at the level of the lesser Technicians. Only the chief Technicians could converse with the Olgarchs.

They glided to a halt, whipped over to a landing platform. For an awful moment Sam thought he was slipping, would plummet downward the five thousand feet he had journeyed. The solid stance felt grateful to his muscles.

Tomson beckoned them on. A frescoed panel opened. They went in.

A simultaneous exclamation burst from ancient Greek and middle-period American alike. Sam blinked. At first it seemed as if they had come out upon a sky of lambent hue. Above them

stretched a vault like that of heaven itself, with glowing stars, a silver moon that swung in slow orbit from side to side. Then he realized what it was. A very cunning and magnificent representation, on a vaulted dome, of an ancient sky, projected by invisible mechanisms, even like the planetariums of the twentieth century. Which meant that this building, or city, or world, whichever it might be, was wholly inclosed from the rest of earth—a cosmos self-contained, unitary.

HE HAD NOT long to speculate. Tomson beckoned them into a tear-drop conveyance of white metal. They got in. A pressure on an inset and they darted off, rising low in the air, skimming over the level at a speed that Sam estimated at five hundred miles per hour. Yet there was no motor, no gears, no whirling propeller. Nor did the wind whip through them as it should. Sam could only figure that somehow the strange vehicle carried its own shell of air along with it.

Kleon pressed close to him, gripped his sword fiercely. This was magic beyond his knowledge. Sam grinned encouragingly at the Greek. "Something like this was in my time also," he told him. "It is better than horses or chariots."

An understanding had arisen between the two. They felt closer akin to each other than to Tomson, who represented the future. And Sam, however lamely, could speak the Grecian tongue.

Sam leaned over the side, breathless. It was paradise over which they were skimming. Everywhere, up to the dim slope of the domed horizon, were white-glowing dwellings, noble parks, artificial lakes, limpid, pellucid; skimming cars like their own, carrying commanding figures, tall as themselves, nobly proportioned, quite unlike the Technician who guided them. Nowhere was there any

sign of machinery, of activating power, of the teeming swarms of the lower levels.

"Something tells me," Sam gritted between his teeth, "I'm not going to like this."

But there was no time for further observations. The conveyor car dipped, glided to the ground in front of a building gleaming in blue and gold. They were in a great park. Fountains splashed; music played softly; trees festooned with bright orange blossoms waved in an invisible breeze.

They got out quietly. Tomson stepped upon an oblong section of red metal, bowed toward the blank walls of the building with low genuflection. Sam watched him with narrowed eyes.

Kleon nodded with a pleased smile. "I knew he was but a slave," he said to the strange companion with whom he had been thrust into this future. "Only a slave would bend so humbly. Soon we shall meet his lord. I, a free Greek, am the equal of any one."

A voice issued from the building. "Enter, Tomson. You have done well." The wall seemed to roll back on itself. They went in. The wall retracted behind them.

## V.

TOMSON said nervously, "Forgive this unusual intrusion, head of the Olgarchs. But this is a problem which only you can solve."

Sam and Kleon stood a little apart, both straight and proudly erect. Of an equal height, the Greek was blond and blue-eyed, chiseled of feature; the American darker-hued, weather-tanned, keen of eye, firm-chinned. Two thousand years of civilization separated them; yet they were both men, in the sense that Tomson, for all his trained knowledge and intellectuality, was not.

Blue eyes and gray gazed steadily at Gano, head of the Olgarchs, apex of the

city of Hispan. Gano did not resemble much the other Olgarchs of whom they had caught fleeting glimpses. He was thickset, sturdy of body and limb, with a massive head and craggy features. His hair was midnight black and his nose boldly jutting. But his eyes were decisive, penetrating, yet impenetrable themselves. He sat on a low divan, his long, thin fingers idling over a desk panel before him on which colored squares glowed and darkened in irregular succession. A signal board, Sam rightly decided.

Gano nodded. "I know, Tomson," he said brusquely, as one too busy to waste precious moments. "I have received visor-signals of your find and of your coming." He turned, surveyed the two men of an older day keenly from under shaggy brows, said, "One speaks the language of Hispan, in a fashion. The other does not. We must remedy that." He raised his voice slightly. "Beltan, take these creatures whom the foundations of our city have yielded and teach them the proper speech, so that we may converse at ease."

From a corner of the long, simply furnished room a figure arose. Sam had not noticed him before. He came toward them casually. He smiled and his whole face lighted with the brightness of his smile. Sam warmed to him at once. "This chap is more like it," he told himself.

Beltan was an Olgarch, one of the ruling class, but he did not seem to take his position seriously. He even grinned at Tomson. It made the Technician uneasy. "It was not proper. He knew his place in the scheme of things, and Beltan should likewise. But Kleon relaxed his grip on his sword. He, too, recognized a man in this Olgarch of the future, a man after his own heart.

"Strange," thought Sam, watching the pair, "how alike they are! Proud poise of head, bright, tawny hair, clean-

cut, classical features, a certain arrogance of those who never knew superiors. They'll hit it off pretty well—even if ten thousand years separate them. As for me"—he shrugged his shoulders—"this Beltan looks all right. But Gano, the others, the whole set-up, I'm afraid that——"

Beltan said with a certain light mockery. "Come with me, you two who have survived from some remote past. Let me teach you the nice intricacies of our proper tongue. Then you may judge if it were wise for you to leave your own time for the noble hierarchy that is Hispan."

"At times," Gano cut in sharply, "your nonsense bores me, Beltan."

The young Olgarch bowed. There was a twinkle in his eye. "At times it bores me, too, noble Gano. That is one of the penalties of having been born an Olgarch."

Gano frowned, turned abruptly to the Technician. "Return to your duties, Tomson."

THE chief Technician muttered submissive words, fled from the room. There was a shocked expression on his face. Sam grinned. Tomson, he felt, had a good bit of a Mid-Victorian Philistine in his make-up.

Kleon muttered aside to the American. "What do they say?"

"They say," Sam told him, "they will teach us their tongue. I know something of it already. But for you it may be hard."

Beltan took them out of the council chamber, into a side room on whose walls abstract figures were stamped in gold.

"How," inquired Sam, "do you expect to make much headway with my very recent friend, Kleon? He is a Greek before my time, and knows nothing of English."

"English?" repeated Beltan with raised eyebrows. "Ah, you mean Hispana. He will learn as fast as you who have a smattering. Perhaps you are not familiar with the Inducto-learner." He waved toward a metal helmet suspended at the end of a long, transparent tube, whose other end entered the ceiling and disappeared.

Sam shook his head. "Never heard of it," he confessed. "In my day we spent half our life learning things and the other half in forgetting them."

Beltan laughed. "We Olgarchs waste no time in achieving knowledge. It comes to us ready-made. The Technicians toil and we garner the fruits. It is simple enough. An Olgarch on birth, or you, for that matter, place your head within the reception chamber. Short waves, oscillating at high speeds, and automatically attuned to the wave length of your particular brain, pulse through the tube. The latter leads to the cubicles of the chief Technicians. At the signal, the proper Technician adjusts his own sending unit. He concentrates on the subject of which knowledge is desired. His thoughts, converted into current, are transmitted inside your skull, make the necessary impress on your neurone paths. Behold, you have learned, well and painlessly."

Sam was impressed. "And the Technicians, do they learn the same way?"

Beltan looked surprised. "Of course not. This is for the Olgarchs only. But do you enter, Sam Ward."

Sam hesitated, grinned and placed his head boldly within the helmet. Beltan made the necessary adjustment. Then he pressed buttons on an instrument board.

At first Sam felt only a gentle tingling, a slight massage of his skull. Then words began to flow into his consciousness, thoughts which he had not originated. His mind was no longer his own; alien speech beat upon him—words







*Nor did the wind whip through them as it should. Sam could only figure that somehow the strange vehicle carried its own shell of air——*

that were the same as those to which he had been accustomed, yet strangely distorted, clipped, shorn of unnecessary syllables. Subtly, the feeling grew that this was right and proper, the older speech an anachronism, not fit for present use.

When Beltan gestured for the removal of the helmet Sam was speaking Hispana, the English of the ninety-eighth century. "There, you see," remarked the Olgarch approvingly. "It is all very simple. And now, Kleon, who have been called the Greek, do you likewise."

Kleon was a very brave man, otherwise he would not have thrust his head without hesitation into the inclosure. This was powerful magic, he was certain, more powerful even than the incantations of the gymnosophists. Aristotle, Zeno, would never have approved of these barbarous practices. But he went—

## VI.

BACK in the council chamber the four men sat again—Gano, Beltan, Sam Ward and Kleon. They understood each other now, spoke the same tongue. But their thought processes were wholly different. Nor could this be helped. Heredity, environment, custom, the training of a lifetime, slow evolutionary molding could not be changed in a moment, not even by the marvelous science of Hispan.

Gano was courteous, if condescending. He listened patiently, first to the story of the Greek, then to the supplemental tale of the American. To him they were primitive savages of an elder day, interesting because of that, but wholly inferior to the Olgarchs and Technicians of Hispan. But Beltan listened with quiet eagerness to their respective pictures of earlier civilizations, of the glory of Greece and the march of Alexander into Asia, of the literature and drama of that ancient conglomerate of city

states. It is true that he smiled at the naive scientific conceptions that Kleon brought forth, but the concepts of the Grecian philosophers struck him forcibly.

To Sam's story of the world of the twentieth century he listened more skeptically and with a certain fastidious distaste. The particular glory of that era—the march of science—he dismissed as mere halting steps toward the future. But the story of war and greed and human conflict, of waste and incredible futility, of shorn forests and mineral resources, of the World War and the League of Nations, of concentration camps and the Spanish madness, brought grimaces to his lips.

"No wonder," he said slowly, "the whole world died not long after your time. Your twentieth century represented a retrogression, a relapse into futile barbarism from the rather noble era of Kleon."

Sam bristled at that. No man likes to hear his own century impugned, and another cried up in its place, especially by the member of a third epoch. "Perhaps," he said heatedly, "I have been a bit more honest in my descriptions than Kleon. For example, he told you nothing of the slavery that existed in his day, the very fundamental upon which his civilization was based."

"I see nothing wrong in that," Kleon declared with dignity. "It is only right that those whose brains are dull and whose backs are strong should support in leisure those who can bring forth large thoughts and meditations. Has not this Hispan likewise its slaves—its Technicians and Workers—to bring the flower of Olgarchs like Gano and Beltan into being?"

Gano relaxed not a muscle of his face, but Beltan threw back his head and laughed. "By the hundred levels of Hispan, even in that early age the Greeks had learned the art of flattery. You are not quite right, friend Kleon. These are

no slaves; these are but fixed castes of society, each with its duties firmly ordered. Hispan could not long exist without such strict, efficient subdivisions. Neither Workers nor Technicians are other than content with their lot." He smiled bitterly. "That is left only as the last privilege of the Olgarchs."

"Rather," Gano interposed calmly, "it is your peculiar privilege, Beltan. No one else of our class feels the necessity for such a primitive emotion. Sometimes I think you are a sport, a mutant, not a true Olgarch."

SAM turned to the head of the Olgarchs. "What," he asked with a certain irony, "is the true function of the Olgarchs in this society of Hispan? The Technicians, I understand, supervise and create the scientific mechanism by which the city lives; the Workers lend their brawn and muscle to its functioning; but the Olgarchs?"

Gano frowned. "We live," he answered sharply. "We are the reason for the creations of the Technicians, the labors of the Workers. We are the flower to which they are the roots and stems and leaves. They work, so that we may enjoy."

Kleon nodded approvingly. "Hispan is not far apart from Athens," he said. "There is much good in your system."

Sam set his teeth. "That," he declared, "has always been the rationalized justification for slavery, even to this future time. Has it ever occurred to you that the slaves—call them Technicians, Workers, Helots, what you will—would also like to live?"

"They are content, happy," Gano answered softly. "Ask Tomson, if you will, whether this is not the best of all possible worlds."

Beltan leaned forward. "Have you already forgotten, Sam Ward," he mocked, "what you have told us of conditions in your own world? What were

the Workers then if not slaves? Slaves who worked at the beck of others, who toiled far longer hours than the Workers of Hispan, who starved in times of depression and starved only more slowly while employed, who went to war to fight and kill for the benefit of others. Did you not have also your Technician class who toiled in laboratories and created new inventions for the benefit of your wealthy, your Olgarchs?"

"Yes, I suppose so," Sam admitted unwillingly. "But at least they were free to work or not to work."

"To starve, you mean." Then, suddenly, the irony was gone from Beltan's voice, and a certain fierce sincerity took its place. "It isn't the plight of the Workers and Technicians that matters. They are well taken care of in Hispan; they do their work and are happy and content. No, it is the plight of the Olgarchs, the lords of Hispan, that matters most profoundly."

"Gano; here, at least has the illusion that he is performing a necessary function. The chief Technicians listen respectfully to his orders, obey them. But the city would flourish just the same if Gano never gave an order. As for the rest of us, we haven't even that poor illusion. We sit and dawdle and wrap ourselves in fine garments, listen to fine music, eat delicate fare, strut and stroll and discuss in noble-sounding, empty phrases. We are parasites, aimless, unnecessary. We are excrescences on the body politic. The city could see us vanish and continue its course without a single jar."

Gano was on his feet, his black brow clouded. "Beltan," he said sharply, "even an Olgarch may go too far."

Beltan's nostrils quivered. There was defiance in his gaze. Then he subsided with a quizzical smile. "You are right, Gano," he murmured. "Even an Olgarch may go too far."

Kleon was puzzled. He was mightily

taken with Beltan, but he did not understand his dissatisfaction. "If the uses of philosophy fail," he interposed, "as they sometimes do, there is always the heady pursuit of war against the barbarian, the stranger."

The young Olgarch said sadly: "There are no barbarians or strangers, unless it be you two. The city of Hispan is all that remains of the world."

Sam gasped. "Do you mean that New York, London, Paris, the great countries, have been wiped out? How? Why?"

Beltan did not seem to see Gano's frown, or seeing, paid no heed.

"THE STORY," he replied, "is not often told, and then only to Olgarchs. But since you already know about the once external world, there is no harm in telling it to you. Not long after your time, Sam Ward, in about the twenty-seventh century, the nations then existing had withdrawn more and more into their own boundaries. It was the logical, if mad development of tendencies in your own era. Nationalism, self-sufficiency, I believe, were the watchwords.

"The process accelerated, so our records report," Beltan continued. "Soon even the national borders grew too large. The nationalistic tendencies, the patriotisms, grew fiercer, more local. Each nation, cut off from intercourse with other nations, bounded by impregnably fortified frontiers, dependent only on itself for its economy, found quarrels arising within its own confines. The fires of localism, of hatred for aliens, of patriotic fervor, finding nothing outside to feed upon, gnawed at their own vitals. Men of one community, a subdivision, a State, a city, derided the men of other communities, boasted of their superiority. They began to fight in internecine warfare.

"New nationalisms sprang up—nationalisms and hates based on smaller

units. The countryside became deserted, as the undefended farms and villages were devastated by the armies of opposing cities. The people collected in the towns, where there was a measure of protection. Soon the cry arose: New York for New Yorkers; London for the men of London; Paris for the Parisians!"

It was now Kleon's turn to nod. Evolution, he reflected, was but an eternal recurrence. For what was this Olgarch of the future describing but Greece in the time of Pericles and the Peloponnesian War?

"Soon," Beltan went on, "earth was broken up into a vast number of self-contained, heavily fortified cities. The old national boundaries were gone; newer and smaller ones took their place. Science advanced. Food was synthesized from inorganic elements; the secret of atomic power was discovered. The units grew smaller and smaller, drew away from each other. They fought, but the defenses were impregnable. The unfortified countryside became wholly deserted, unnecessary. It grew in the course of years into a tangle of wild forests, of desert stretches. All intercourse ceased. The cities rose vertically instead of horizontally along the earth, inclosed themselves in impassable barriers.

"Generation on generation added to these barriers, improved them with new methods of science. Such a one incloses Hispan, once a colony of your United States, now the sole survivor of all the teeming cities that once populated earth. A shield of neutron metal, impassable by any means known even to our science, was built up, layer on layer, around our city. No one knows how unimaginably thick it may be. No one has ever tried to penetrate its width."

SAM WAS appalled. He tried to grasp the story entire. It was logical, he admitted, up to a certain point. The



forces involved were already at work in his own time. But to think that all the world had died, except for this enshrouded city of Hispan! "What happened to the others?" he insisted.

He saw the quick, warning glance that Gano flashed. He noted Beltan's hesitation. "On that," the latter admitted reluctantly, "the records are somewhat garbled. It seems there was a cataclysm some time in the forty-first century. A celestial body from outer space, traveling at high speed, smashed into the earth, destroyed a goodly part, laid waste all the cities but Hispan."

"Why Hispan alone?"

"Because our city was the only one inclosed with neutron walls. Not even the impact of millions of tons could penetrate its solidity."

"And no attempt was ever made to explore outside, to investigate conditions?"

Gano rose suddenly. "There is no way out," he said smoothly, "and there have been questions enough. We have been patient with your rather primitive ignorance, but it is time to call a halt. And remember," he finished meaningly, "these tales which Beltan, who should have known better, has told you must go no further. Only the Olgarchs know of these, and Tomson, the chief Technician, the Workers, the other Technicians even, have no faintest idea that there is a world, a universe beyond this city of Hispan. To them there never was a sun or moon or stars, or earth of other cities and peoples. This is the round entire, the circumscription of their destinies. See to it that they hear no other."

"I see," Sam answered grimly. He was beginning to understand. It was only by a tremendous effort that he held back the rising wrath within him. But Kleon, child of an earlier, franker era, held no inhibitions. "I am a Greek," he declared proudly, "and bow to no man. My speech is my own, and subject to no restrictions."

Sam nudged him sharply. The brave fool was making trouble for them both.

Gano surveyed them thoughtfully, then nodded to Beltan as though he had not heard. "We shall decide on our course later," he said evenly, "when the council meets. In the meantime let these two be held in your quarters. *You* will take care of them."

Kleon's hand strayed to his sword. Sam's mouth set in a straight line. Very casually, his fingers touched the butt of his revolver. He knew what Gano meant. They were prisoners. The Greek, by his defiance, had brought this upon them. Yet he liked the headstrong warrior all the more for his folly. He was a man!

Beltan said with peculiar intonation, "Please come without delay."

Sam relaxed. He sensed the warning against resistance in the Olgarch's voice. Gano's delicately veined forefinger rested on a green square on the signal board. Intuitively, Sam felt that the slightest pressure would release blasting death against them.

"O. K.," he said laconically, in the elder speech. "Let's go, Kleon."

## VII.

IN SILENCE the three entered a waiting car; in silence they sped over the noble park lands to a small, blank-walled building near the center of the level. In silence Beltan escorted them inside, the slide panel clicking smoothly behind them.

Sam cast a swift glance around. The walls were bare and smooth, the furnishings simple. There were no windows or doors other than the way they had entered. "We are prisoners, are we not?" he demanded.

Beltan looked at them with a certain pity. "I am afraid worse than that," he admitted. "Your presence in Hispan will give rise to talk, to-questionings.

You must eventually come in contact with the other castes. You know things of which they have no knowledge. Discontent may arise, dissatisfaction. The ordered peace and security of Hispan may be broken. You especially, Sam Ward, have subversive ideas. You do not like our distribution of functions?"

"I do not," Sam answered emphatically.

Beltan sighed. "I thought as much. As for you, Kleon, you are more sympathetic. But you spoiled it with your defiance of Gano. Still," he meditated, "if you would but admit your hastiness of speech, perhaps an exception might be made in your favor."

Kleon gazed at him with candid blue eyes. "Would that mean I must desert Sam Ward?"

"I'm afraid so."

The Greek stood poised like a young god. "Then I remain with him."

"Even if it means death?"

"Even so."

Beltan turned swiftly to the American. "And you," he inquired, "would you be willing to give an oath that your tongue would always remain submissive to the Olgarchs? Remember," he added hastily, "an answer to the contrary will mean a quiet dissolution. I am but one against many. In any event I shall plead your cause in the council, but my fellow Olgarchs will feel as Gano does."

Sam swallowed hard, but there was no tremor in his voice. "Kleon was right," he answered steadily. "We are not slaves. We can give no such promises."

Beltan sighed again. There was regretful admiration in that sigh. "You are both brave men," he said. "It seems that elder, more primitive day bred sturdier frames than now. Yet you must die. I see no way out."

Sam fingered his gun. He glanced significantly at Kleon. "At least," he

remarked evenly, "we'll go out fighting."

Kleon rattled his sword. "By Zeus and Ares," he swore, "you speak sooth, friend Sam. We'll take a goodly number of these Olgarchs to the lower realms along with us."

"You won't have the chance," Beltan assured them. "Gano controls your fates literally at his finger tips. A pressure on the proper square before him and lethal rays sweep through this structure."

Somehow Sam's gun was in his hand, its cold muzzle pressed against the Olgarch's ribs. "I'm sorry to have to do this," he said crisply, "but we don't give up very easily. You, Beltan, will show us a means of escape, or you die along with us."

THE OLGARCH looked at the two desperate men. Kleon's sword was out, its keen point pressed against his other side. He shook his head slowly. "I am not afraid to die," he answered with simple dignity. "I am weary of this aimless dalliance to which I am bound. Slay, if you will."

Sam stepped back, sheathed his gun. Kleon raised his sword in salute. "You, too, are a man," the American approved. "We three, I think, given the chance, could conquer the universe."

A slow, unaccustomed red spread over the Olgarch's aristocratic features. "Believe me," he spoke earnestly, "I am your friend." Then he made a despairing gesture. "But there is no escape. I cannot help you. No nook or cranny of Hispan is remote from the search screens of the Olgarch council."

"I wouldn't stay here if I could," Sam declared harshly. "Your city of Hispan is a stench in my nostrils, with its brutal caste system, its limited round. Me—I prefer freedom and space and a bit of anarchy even, where men are human beings and not mere soulless cogs in a hierarchic society, no matter how efficient. There must be a way to get out."

"There isn't," Beltan replied somberly. "The neutron walls are impassable. And outside, besides wild desolation in which no man may live, there are lethal gases: Cyanogen, carbon monoxide, phosgene, products of the collision. The atmosphere has been destroyed. We do not even know what, if anything, remains of earth, of the sun itself."

"That," Sam retorted with a grin, "is mere propaganda. Your Olgarchic ancestors must have been singularly adept at that sort of thing. Something tells me they foisted that tale even on themselves, in order to keep their position intact. If ever Workers or Technicians or even mutant Olgarchs like yourself came in contact with other forms of civilization, with other methods, there might be comparisons not at all favorable to Hispan."

Beltan's tone was sharp, quick. "Have you any proof of that?"

"None whatever," Sam admitted. "Call it intuition if you like, or merely the memory of somewhat similar propaganda methods in my own twentieth century."

The flame that lifted in Beltan's eyes died. "In any event," he said dully, "there is no way of ever finding out. The neutron walls cannot be pierced."

KLEON had been singularly silent. His fair brow was furrowed; he seemed plunged in profound thought. Now he raised his head suddenly. "Is there," he demanded, "a mountain within the confines of Hispan where the Titans are wont to groan uneasily?"

Beltan stared. "I do not understand."

"He means," explained Sam, "a volcano."

"No; there is not."

"Then," shouted Kleon, "by the one-eyed Cyclopes, there is a way of escape."

"What the devil—" Sam cried.

"Listen to me," the Greek said forcibly. "The pyramid Hotep built for

me to sleep into this stupid future lay close to the flanks of such a volcano."

"That's true," Sam averred. "I remember it. But what of it?"

"This! According to the formula of the gymnosophists I required the gases from the smoking mountain for my chambered sleep. I drew them in by cunning vents which pierced the central fires. These opened to the day at the top of the mountain. Stones, nicely pivoted, sealed the vents after the gases poured into the chamber. Only I know the secret of their presence, of the springs by which they may pivot once more. The pyramid is within the city; the burning mountain is without. We shall escape by means of those passages which lead far underground from one to the other."

Sam pounded the Greek's shoulder. "Kleon, you are a genius." Then a thought struck him, clouded his joy. "Out of the frying pan into the fire." He grimaced. "Your passages lead to the central fires, you say. That means to the inner crater. We'd suffocate or frizzle to death."

"The mountain may have ceased its complaining long since," Kleon answered calmly. "And brave men die but once."

"Right!" Sam chuckled. "We start at once. We still have the gadgets that Tomson gave us. They'll drop us down the shaft." He stuck out his hand to Beltan. "Good-by," he said. "Thanks! You were the one bright spot in Hispan."

The Olgarch's eyes were inscrutable. "Warnings of your descent down the conveyor tube will be signaled back to Gano from every level," he said. "You'll never reach your buried pyramid."

"We'll chance it," Sam retorted.

"I won't permit such chances."

Sam looked at him incredulously. "You mean you're backing down? I thought you were our friend."

"I mean," Beltan replied quietly, "I

am going with you. The levels will respect my presence."

"You're a good egg," Sam said with feeling. "But it's no go. You'd only get into a mess of trouble when you come back."

"I'm not coming back," the Olgarch retorted patiently.

"Huh! What's that?"

"I mean I'm going out into the strange new world with you." He smiled quizzically. "Didn't you say a little while before that we three, given the chance, could conquer the universe?"

"But—but—" Sam spluttered. "Why, damn it, you can't do this. The chances of our getting through, or of survival even if we do, are a thousand to one. Why should you give up everything—"

"Because I am tired of this life; because in rawness and chaos I may find again that soul you spoke of; because—I am your friend."

The three men, products of three different ages, stared at one another with level brows. Sam felt an unaccustomed lump in his throat, spoke gruffly. "Then we'd better get started—before Gano gets on our trail."

### VIII.

IT WAS EASIER than they had anticipated.

Under Beltan's guidance they darted in his conveyor car for the tube, bailed into the great shaft with swiftness and dispatch. Down five thousand feet they catapulted, meeting Technicians and Workers on their way, getting humble salutes because of the Olgarchic presence, curious glances as they whirled ever downward.

Then the final excavation, the still-yawning chamber which the blasters had laid bare. Harri, back on the job, looked up in alarm at this unprecedented invasion of an Olgarch. But Beltan took the

trouble to explain. The sleepers, he said, were going to disclose to him the method by which they had slept intact these many ages. In the meantime, it was unnecessary for Harri and his corps of Workers to remain. And they were, he added with authority, to hold their tongues.

In seconds the final level was clear.

"Now"—Sam grinned—"strut your stuff, O Kleon." He had noted Beltan's anxious glances at the visor screen implanted in the upper shaft.

It was an even more anxious moment before the Greek found what he was looking for. A tiny, almost imperceptible depression in the ancient wall. A simultaneous exhalation of withheld breath burst from three pair of lips as the section of the wall turned on itself, disclosed a dark hole within. Sam, remembering his former experience, would have held back to determine if hot, volcanic gases would belch forth. But the Olgarch had cried out sharply. "Quick, run! We're discovered!"

They dived headlong into the baleful opening. Kleon flung around, thrust his shoulder against the massive stone. It swung smoothly and soundlessly back into position. They crouched, panting, in utter darkness.

Just in time, too! For at that moment there was a low, humming sound that rose swiftly to an unbearable scream. "Gano has turned on the blasters," said Beltan with a groan. "They'll shear through this thickness of rock in two or three seconds."

But the scream of rushing power gave way to a mightier roar. There was a huge crash, a tumbling, grinding noise. The solid rock swayed crazily underfoot. Then there was silence.

"The pyramid has fallen," Kleon told them shakenly. "There must be a hundred feet of earth and rock and stone behind. All return is blocked."

"Then the answer is forward," Sam responded with a cheerfulness he did not



quite feel. If the volcano was still active, if, in the course of long centuries, the crater had become clogged with lava——

It was a long, steep, arduous climb in total darkness—silent, except for grunts and low curses as they bumped blindly into jagged edges. Up, always up, in fetid, clammy atmosphere——

Then the path widened suddenly and they were at the bottom of a huge bowl. Sam looked up fearfully, then let out a great shout that brought the echoes tumbling about them. "The stars! I see the stars!"

HIGH OVERHEAD, framed in limited blue, were tiny pin points of light, peering down incuriously upon them. There followed a mad scramble, a clawing and backward slithering in crumbling, weathered lava flows of an ancient epoch. The volcano was extinct. The air was foul but breathable.

Then they were out, staring with avid eyes upon the enveloping scene. It was night and the fresh breeze stirred their hair, ruffled their clothes. Three men, of different civilizations, clad in different habits, united only in a common bond of escape, emerged into an incredible world!

To one side, framed by the heights of the Sierra Madre, reared a vast, light-quenching surface. Five thousand feet

it sprang, massive, somber, swinging over the plain to either side as far as the eye could reach. The neutron-walled city of Hispan!

To the other side, past the mountains, a great wilderness stretched interminably without end, without beginning. There was no sign of life, of human habitation, of anything but tangled, savage-crowding trees. There wasn't a light, an airplane, not even a boat on the tideless darkness of the ocean beyond. Even the stars were strange, the old configurations gone.

Sam shivered. It was cold, but it was not that which made his flesh crawl. Suppose the tale of Hispan had been true? Suppose there were no other cities, no other human beings in that shoreless jungle? Suppose——

He turned to the others, grinned. "At least one thing is certain," he said lightly, "the air is good. If deadly gases once existed, they have long since been dissipated or made chemically harmless." He raised his voice, "Forward, comrades, to whatever destiny awaits us!"

"Forward!" cried Kleon, the Greek. "Forward!" spoke Beltan, the Ol-garch.

The three men turned their faces resolutely toward the East, toward the home of the rising sun. Slowly, they descended the mountain.



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# BLUFF

*Article No. 16 in a study of the Solar System*

by John W. Campbell, Jr.

THE PROBLEM of the origin of the solar system has not yet been satisfactorily explained for the relatively orderly planets (all revolving about the Sun in the same direction in almost the same plane) and the planetoids (which all revolve about the Sun in the same direction, and in a comparatively narrow plane). Comets remain haughtily aloof from the attempts at explanation. They don't revolve about the Sun in the same direction. Every single one of them is the complete individual. They have their own orbits, and every orbit has its own plane. The only laws they obey are the laws of motion and gravity. Any orbit those fundamentals allow, a comet finds, sooner or later. The rest of the solar system is pretty much of a pancake, but not the comets. They come slanting in at any angle, from any direction, and at almost any distance.

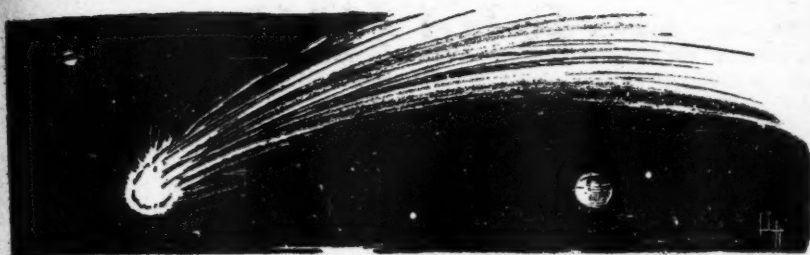
A planet is almost a point, for observational purposes, and therefore can be located accurately. Not so a comet; some of them have heads half the diameter of the Sun. The tail of a comet may stretch out across more than 100,000,000 miles of space, and be as much as 20,000,000 miles in diameter. That does not make for accuracy of observation, and to make the problem even more brutal, they cannot be followed, even in powerful telescopes, over any great arc of their orbits. Few comets have been followed out beyond the orbit of Mars. Therefore, in determining the orbit of a comet, we must work on (inaccurate) data gained while it traced a tiny fraction of its im-

mense orbit near enough to the Sun to be illuminated brilliantly, and visibly.

But for all that, the comets represent the only observable bodies that plumb the outermost, black depths of the solar system. Those wanderers loop out in vast orbits to the far, raveling edges of the Sun's gravity, moving out there at those immense distances, 3,000,000,000 to 10,000,000,000,000 miles from the Sun, at creeping paces for perhaps millions of years before, at last, they sweep, very slowly at first, back toward the Sun.

But a comet that retired to 10,000,000,000,000 miles and a comet that retired to 100,000,000,000,000 miles would both fall back at last, in almost precisely straight lines. The tiny fraction of its orbit near the Sun, a month, perhaps, out of a million-year orbit, would in each case be almost exactly a parabola. The 100,000,000,000,000-mile comet would probably retire—and not fall back. With data made inaccurate because of the huge, blurred image of the comet's head, we must draw a fine, thin distinction between the true retiring-to-infinity parabolic orbit, and the elliptical orbit that simply loops out for a near-infinite distance before returning.

We can't, as a matter of fact. About 400 comets have been observed, and orbits computed. Of those 400, 300 seem to have parabolic orbits. Astronomers have decided that they don't, not because of more careful observation, but because a parabola is the orbit a body must take under the following conditions; it must originally be at rest with respect to the



*The rest of the solar system is pretty much of a pancake—but not the comets. They come slanting in at any angle—from any direction—*

solar system at a distance almost infinite. Such a body falling into and coasting back out of the Sun's gravitational field would follow a parabolic orbit, but none other could. Those 300 out of 400, then, would have to represent 300 bodies not originally connected with the solar system, and yet, by pure chance, traveling along through space at exactly the same velocity and in exactly the same direction.

The chance is too remote. Those 300 are almost certainly true members of the system; comets, simply, that retire to such immense distances that they seem to go out forever.

IF A BODY roving through space, free entirely of any stellar system, should chance to stumble through our system, it would take up an hyperbolic orbit due to its own original motion relative to the solar system. No such comet has been observed; the only hyperbolic orbits detected have been traceable to the perturbation of a parabolic orbit due to the influence of a near-by planet's mass.

All other observable bodies of the solar system lie in or near the plane of the planetary orbits; only the comets plunge wildly out in any direction, at any angle. Were they captured by the Sun as they wandered free through space? In many ways it seems unlikely, for an unattended star can capture a freely roving body only under very special circumstances.

If a body at rest outside the system were to fall in toward the Sun, it would gather speed with every mile of its immense drop. When it finally neared the Sun, it would circle it in a parabolic orbit with terrific velocity. And that terrific velocity would not be entirely dissipated by the dragging gravity of the Sun until the comet had at last returned whence it started—outside the solar system, still free of the Sun.

If it were moving relative to the Sun, the fall into the system would again carry it out, this time in an immense hyperbolic orbit—still free of the Sun.

Two special cases could change things: if the comet passed so immensely close to the Sun that it actually plowed through the resisting solar atmosphere, the slowing action would break the parabola or hyperbola to an ellipse, and the comet would be captured.

If, in the case of a body moving relative to the Sun originally, the direction and amount of relative motion were just right, the original energy of its motion might, for a time, struggle against the Sun's attraction, till it was overcome. The result then would be that the original energy of motion was lost, and, into the bargain, the comet would be at rest relative to the Sun, well within the Sun's gravitational field. The fall to the Sun, and the swooping dive on momentum outward again would find it at rest, once more, at the same distance from the Sun, captured.

This latter theory of nature will not account for the existent comets. Only *one* direction of motion would permit such capture, and hence all comets so captured would retire from the Sun in orbits in the same plane. Comets, conspicuously, don't.

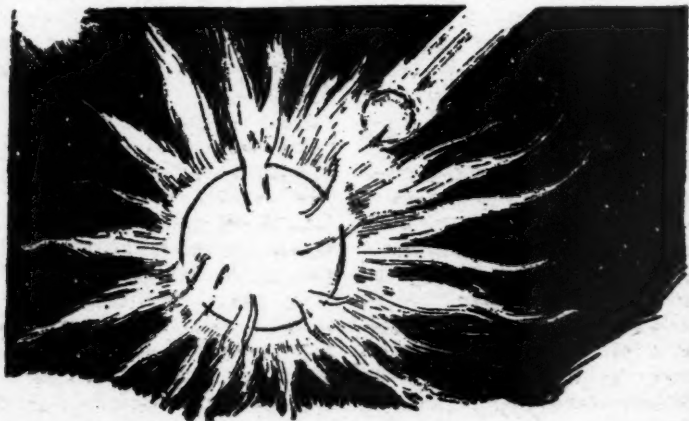
But a stellar system attended by planets—that's something else. Our solar system is a 9-jawed, cosmic trap for spatial wanderers, and Jupiter is the chief jaw. Imagine a comet falling in from space, diving down just in front of Jupiter as he swings round in his orbit. Say Jupiter is 100,000,000 miles from the point in his orbit the comet will pass; his gravitational mass tends to deflect the comet's path toward him. While it is outside his orbit, Jupiter, millions of miles distant still, hastens its fall by his attraction.

Then the comet passes the orbit, in front of the planet. Jupiter moves in behind. Now, Jupiter is not hundreds of millions of miles distant; he's moved in, say, within 100,000 miles instead of 100,000,000. Further, he's no longer speeding the fall, but dragging back with his mass, and the mass of 4 giant satellites. He's putting on the brakes a lot harder than he helped it along. The comet is not falling freely to the Sun; it cannot retire freely into infinite space;

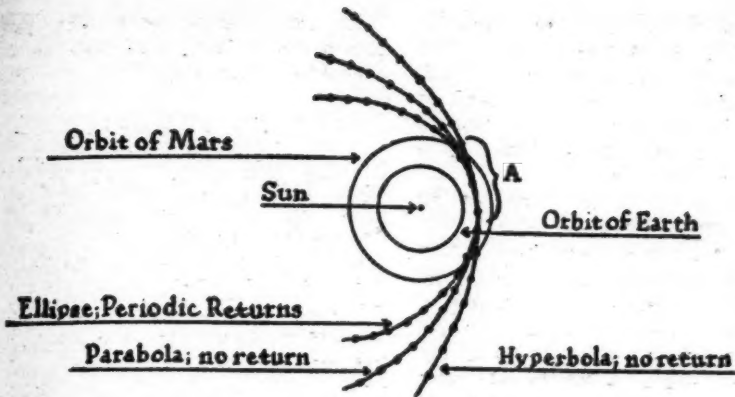
it has lost so much speed pulling past Jupiter that it retires in an ellipse, not an hyperbola. Captured!

SATURN, or any of the other planets can do the same; though naturally Jupiter, because of his far greater gravitational field, reaching out millions of miles, is the most serious obstacle. But even this will not account for the comets; they'd all have to pass near the plane of the planets if this were the secret. A remarkable number do, as a matter of fact, and they pass close to Jupiter. A comet doesn't have to come from infinity for Jupiter to make general alterations in its orbit; Jupiter severely works over anything that comes within a million miles of him, and, in the ages of time, a good many comets do. If they pass near him—just once in time—they pass near him from then on, if they stay in the system.

Because Jupiter works both ways; if a comet passes *before* Jupiter, it has its orbital period reduced. Brook's Comet 1889 V had a period of 29 years up to 1886. In that year, however, it passed within 56,000 miles of Jupiter. It's period was reduced to 7 years, and it is forced forevermore to return again to a point near Jupiter's orbit, where, in time







## Fig. 1 PARABOLA, ELLIPSE & HYPERBOLA

*Note: If the comet is observed only while it is traversing Arc A, it will be nearly impossible to determine which of the three orbits it is following.*

to come, Jupiter will again go to work on it.

Lexell's Comet of 1770 passed close to Jupiter in 1779, but it passed *behind* the planet. Like a stone from a cosmic sling, Jupiter accelerated it violently, hurled it out from the system. It has never since been seen.

Jupiter has quite a family of comets—bound by the titanic force of his far-reaching, gravitational arms. But there are, too, groups of comets of a different sort, a chain of comets that follow one immense orbit, one behind the other, like the links of a chain on an immense sprocket, with the Sun as its center. The great comets of 1668, 1843, 1880 and 1882 belong to one such group. They are not recurring appearances of one body—though they look much alike, have the same general characteristics—but separate individuals following one immense orbit. They cannot be the same, for all revolve in an orbit having a period of 600 to 800 years. (Indefinite, because we can observe them only during a few months, over a tiny por-

tion of their immense arc.) These comets are interesting, further, in that they passed within 200,000 kilometers of the Sun's surface, actually within the vast, tenuous flames of its corona. Moving more than 500 kilometers a second at that short distance, they circle half round the Sun in a few hours.

They retire in the direction of Sirius; but they do not come anywhere near that star, for as they race from the Sun, their speed declines rapidly. Though Sirius is one of the nearest of the stars, they would not, even in 1,000,000 years, or 2,000,000, cover an appreciable fraction of the enormous distance to Sirius. When near the Sun, they were objects of dazzling splendor, immense tails flashing out from them for more than 100,000,000 miles, extending far out, beyond Earth's orbit, as a tongue of flame across all that space.

In addition to the unsolved problem of their origin, is the problem of their constitution. This, however, we have some means of understanding. To the eye, and even the telescope, the head of

a comet appears as a solid thing of immense size. It is, however, no more than a loose collection of particles of matter, fragments of iron and rock held together by a slight mutual attraction. Since there is nothing in space to disturb them normally, those minute mutual attractions are sufficient to hold them together. However, if any considerable exterior force acts on them, the feeble attractions weaken drastically, and the entire comet may be shattered. In the far depths of space, there is little that can serve to wreck them, but the deeper heart of the system is a danger ground. Their approaches to the Sun mean inevitably that solar tides varying inversely as the cube of the distance will beset them. Planets that pass near, or even at considerable distances, will raise disrupting tides. The pressure of the Sun's light, the chance encounter with a sizable meteor, all may serve to bring about disintegration.

In 1846 Biela's Comet, which had been observed at intervals of 6.6 years since 1772, returned again. The comet was a member of Jupiter's captured family, but until December 20, 1846, it displayed no unusual appearance. On that night, however, it was considerably elongated. By January 1, 1847, it had become 2 separate bodies, traveling in parallel paths a quarter of a million kilometers apart, each having its own head and tail, but at times linked by a faint arc of light.

At their return in 1852, the 2 components were 2,000,000 miles apart. Several times since, when they were due, the area where they should have appeared has been carefully searched, but they have not been seen. They were due however, in 1872 and 1885, 2 years which furnished exceptionally fine showers of meteors, the Andromedes, which move in approximately the path of the lost comet.

The Great Comet of 1882, which passed so near the Sun, was broken up

by it. So brilliant originally that it was visible in full daylight, after passing the Sun, as many as 8 separate fragments were detected, near to, and traveling parallel with, the main body of the comet. In a year it had passed beyond the scope of the greatest telescopes. In approximately 1,000 years the comet should return. By then, so far separated will the parts have become, that, in all probability, the various fragments will appear at intervals of as long as 100 years.

THE STRENGTH of the gravitational bonds holding the comets together is, however, exceedingly hard to determine. That it is no feeble force is evidenced by the fact that, passing through the corona itself, the Comet of 1882 was not entirely destroyed, but just chipped slightly, so to speak. The mass of Halley's Comet has been estimated to be about one fifty-millionths that of Earth, an astronomically minute thing, but yet a mass of some 1,000,000,000,000 tons. In 1770, Lexell's Comet passed within 2,000,000 miles of Earth, and its orbit was greatly changed by Earth's pull. But Earth was not affected detectably in return. Had the mass of the comet been as much as one thirteen-thousandths of the Earth, the length of the Earth's year would have been permanently altered by about one second.

When Brook's Comet's orbit was changed by Jupiter's attraction from a 29-year period to a 7-year period, it spent several months within the limits of Jupiter's satellite system. Yet even the comparatively sensitive small masses of the satellites were not detectably altered. The gravitational method of comet analysis fails simply because the comets are too small gravitationally, certainly less than one one-millionth Earth's mass.

Yet a typical comet may be 100,000 kilometers in diameter. If such a comet had the evidently very high mass of one one-millionth that of Earth, its average density would be only one six-hun-

hundred-and-forty-thousandths that of ordinary air. It has been shown that the light of stars passing through 100,000 kilometers of cometary material is not appreciably refracted.

These figures deal with the *heads* of comets; the tails are even more tenuous. And they are even more puzzling. The tail usually curves out from the comet in a manner suggesting a repulsion from the Sun, and the general theory of this repulsion is that it is brought about by pressure of light.

struck by the light of the Sun, are given considerable velocity away from the center of radiation, thus giving rise to a stream of gas trailing away from the Sun, frequently not behind the comet. When a comet is retreating from the Sun, in fact, the tail precedes it, to a certain extent.

But even this does not explain it perfectly; sometimes a comet moves so that, for example, the line joining it and the Sun sweeps one degree. Instances have been found where, in the same interval,

*Note: The curve of the comet's tail is a complex resultant of the comet's motion and the effect of the sunlight's repulsion.*



## Fig.2 CURVATURE OF COMETS TAILS

Since light is energy, and physics has shown that energy has mass, it follows that mass moving through space at an immense velocity must exert pressure on anything it strikes. This pressure can readily be detected by direct measurement. It is typical of meteoric material\* (which seems to be about what comets are made of) that, when heated, large volumes of gas are released, gases absorbed in the solid particles as water is soaked up by a sponge.

Apparently, comets coming near the Sun are heated by radiation, and gaseous material driven out. The gas molecules,

the tail has moved through an angle of  $16^\circ$ !

The spectroscope can give no information as to the constitution of the swarm of solid particles that make up the head of the comet. However, the gaseous discharge is excellent material for the spectroscope, and the tail can be studied. As the comet retreats from the Sun, the tail continues to radiate for some time, as the molecules composing its gases have been greatly "excited" by the radiation they absorbed. Some of the energy has been stored. However, a large part of the light, which makes the tail visible,

is sunlight reflected. The light available, furthermore, is not intense enough to make spectrum work easy.

To the extent they shine by their own light (reradiated after absorption) comets can be analyzed. The bands detected indicate the presence of nitrogen, carbon monoxide, cyanogen (a carbon-nitrogen molecule, CN), and various hydrocarbons, many of them highly unsaturated. Methane,  $\text{CH}_4$ , is the lowest-saturated hydrocarbon, but molecules such as  $\text{CH}$ -,  $\text{CH}_2$ - and  $\text{CH}_3$ - have been detected, in which the carbon atoms lack one or more hydrogen atoms of satisfaction. Some sodium vapor has been detected as well.

IT HAS BEEN suggested that the comets originate in vapors ejected from the Sun at high speed, vapors such as those forming the enormous prominences frequently observed during total eclipses. These, it is believed, are supported by light pressure. If the pressure hurls the atoms of matter out from the Sun at high speed, and continues to accelerate it for a while, it may be driven out to immense distances. If it reaches a distance 32,000 times that of Earth, it does not reach its turning point for 2,000,000 years. For more than 1,000,000 years its velocity, with respect to the Sun, is less than one kilometer a second. During these ages, the matter condenses; its chondrules are drawn to-

gether by mutual attraction. Through long ages, the distant stars have an opportunity to work on them, giving cross pulls and slow components that, when they fall again toward the Sun, make them slant a bit, allow them to fall into orbits instead of directly back to the Sun.

If this proposed mechanism is correct, comets—and meteors, which seem to represent a degradation product of comets—unlike any other members of the solar system, are entirely cyclic, being produced at one end and destroyed at the other end of a never-ending cycle. Further, since the Sun radiates light in all directions, it is understandable that those wisps of light-driven matter should so radiate. The resultant comets, then, could logically be expected to return in orbits from any direction, in any plane, and rotate about the Sun in any direction, for the cross tugs of the almost infinitely remote stars alone may determine that.

But whatever their origin, comets appear to be a sort of cosmic Charlotte Russe: noble in proportions, brilliantly attractive, but consisting largely of a sort of whipped cream of tiny glassy or metallic particles in an almost non-existent, gaseous froth. Of grandiose proportions, hundreds of times larger than Jupiter in volume, their feeble bluff fails to disturb, in the slightest, Jupiter's smallest satellites, or, even, to refract the faint, far light of stars.

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# AIR SPACE

by K. Raymond



*We could dimly see Professor Bissell—looking like a visitor from another planet in his queer air suit—through the clouds—*

**N**EBULOUS and unseen as the air upon which he intended to experiment, was the feeling of forthcoming disaster that brooded over Professor Nicholas Bissell's laboratory that ill-starred night.

Professor Bissell, one-time instructor in meteorology on the staff of Wash-

ington College, was one of America's greatest scientists in the field of atmospheric phenomena.

The professor was a stocky, gray-haired man of fifty. His outstanding physical feature was his huge head, with its high, broad forehead beneath which were keen, wide-set eyes of gray. It

was the wonderful brain in that great head which enabled Professor Bissell to discover that air is something more than a substance enveloping man as ocean waters envelop fish. That great brain let him see what we of lesser reasoning power could not—that *air is actually space itself*.

Up to that ill-fated night not one of us five news hounds, sent there to cover Professor Bissell's scientific experiment, would have believed that air could possibly be space. True, we knew that air played a many-sided part in human affairs, was something quite necessary to man's existence: air must be breathed; it helps fuels burn; we can talk to one another only because of its presence; air makes water possible, tempers heat and cold, even stops meteors from striking and killing all humanity—for it burns meteors up through friction.

But that air was something far greater than all these things, only Professor Bissell knew and proved—to his own undoing.

The professor had arranged that we of the Washington, D. C., press be in his home laboratory at eight sharp that July evening. Not that this eminent scientist wanted publicity—far from it. But the editors of the various newspapers we represented knew that he was good copy; and, always agreeable, Professor Bissell had consented to reporters seeing the latest of the many novel experiments for which he was deservedly famous.

Now that we five had gathered there, Professor Bissell was holding forth as though we were a student class. It was evident that he wanted everything clear in our minds before matters went further.

"Gentlemen, what is air?" he asked rhetorically, as we grouped around him, notebooks in hand. "Of course we do not really know. For centuries mankind was not aware that air existed. And think, gentlemen, only two hundred

years ago no one even knew what air was made of. Though we of to-day can analyze its content gases, we are still at a loss concerning its true nature. Have you never wondered why air, though it is a mixture of substance gases chemically uncombined with each other, never varies in composition—with the exception of water vapor, which it merely holds in invisible form—wherever it is found by man? It never varies—"

"What about the lack or presence of ozone?" I interrupted somewhat skeptically.

Professor Bissell's great head, with its wide-set, gray eyes, turned toward me. An indulgent smile, the sort one gives a somewhat forward youth who speaks through innocent ignorance, slowly spread over his large, smooth face.

"Ozone is but a variety of oxygen, Mr.—ah—O'Grady," he said calmly. "It has nothing whatever to do with air which contains it. And air—this is my carefully thought-out theory, which tonight's experiment is intended to prove—is *actually space itself*."

I CHUCKLED at his last words, and the other news hawks of the Washington sheets looked daggers at me.

Jamison of the *Chronicle* even muttered *sotto voce*: "You eagle-beaked redhead! Can't you treat a great scientist with proper respect?"

I chuckled again. Inwardly, I was as respectful to Professor Bissell as they. My news-hound boldness had a sound purpose behind it. A great scientist like the professor seldom explains his work in detail. He does not believe the average person will understand. But sting such a man into a heated argument and you will soon have scientific facts he would otherwise have left out.

I was prepared for a little discussion, too. Purposely, I had the previous night

gone to the public library and read Professor Bissell's weighty book titled "Empire Of The Atmosphere." I was thus—to the surprise and chagrin of my less-informed fellow leg-men—able to use some of the scientist's own facts in argument with him.

"Come now, Professor Bissell," I said, showing a smiling doubt, "you can't mean that space and air are the same! Why space is *nothing*—it hasn't even weight! But air—a cubic foot weighs one ounce and a quarter at sea level. A thirty-foot cubical room holds a ton of air. And all earth's air is figured to press against earth with the tremendous weight of around 5,633,000,000,000,000 tons! So air can't be empty space, professor, because space is nothing and weighs nothing, whereas air is something and weighs plenty!"

Blue-serged Professor Bissell nodded his great head. "You are probably a smart reporter, my boy. You also seem to know a little about meteorological science. However, your words only prove how easily a bit of knowledge may be used to draw dangerous conclusions. You think that because air in motion can be felt, and because it is proved to have weight, it cannot, therefore, be space. Space must be an empty nothingness to you.

"My boy, you should read Sir Oliver Lodge, really. He would prove to your satisfaction that ether, for example, a subtle medium permeating space—which by your reasoning should be actual space because we can neither see nor feel it directly—is, in reality, the densest, heaviest medium in the universe. So you would have space a weightless nothing? Ridiculous!"

I scratched my head, wrinkled my brow, and then smiled wisely. "You win on that point, Professor Bissell, but I think I have you now! If air is space, what about a vacuum made when air is withdrawn? Would you call that twice as empty as space?"

Jamison, standing next to me, gave a strong yank on the bottom of my tweed suit coat and whispered, "For Heaven's sake, O'Grady, stop arguing with a scientist who knows ten times more than you do! You crazy red-head! We're here to see and report a great experiment by the professor—Shut up, will you? You're only holding up the works!"

A slight irritation was in Professor Bissell's wide-set gray eyes as he answered my question. "I am sorry, my boy, to have to inform you that nature hates a vacuum. That phenomenon does not exist in nature. Also, she has seen to it that, as yet, no perfect vacuum has been made by man. Always a few molecules of air remain in a so-called vacuum. These expand—since air, which is space, is very fluid—and thus space remains within such a *theoretical* vacuum. Perhaps it is a thinner sort of space. At least it would so seem. As to that, we have no way of knowing—as yet.

"But, we shall soon know," Professor Bissell continued slowly. "Mr. O'Grady, you have brought up the very point around which to-night's experiment centers: the strength of the remaining air space in a vacuum. Briefly, I intend to break open extremely thinned air space. If successful, I shall learn what, if anything, *lies beyond*."

I HUMMED my surprise along with the other four reporters clustered around Professor Bissell. Testing the strength of air space? Breaking space open to see what lay beyond? Surely these things were incredible—and impossible to do! Also, it was hard to believe that space could be stronger and heavier at any one time than another, according, as I understood the professor, to the degree of air-space density that existed. In other words, its thinness.

Fat Dave Brooks of the *Sun* wheezed

a hasty question. "Where—where is this space experiment—going to take place?"

"Here, in this laboratory."

"Oh, oh! I'm leaving!" wheezed Brooks.

"Wait——"

Professor Bissell walked past tables with glass air-analyzing instruments on them to what I thought was the rear wall of the laboratory. The supposed wall was completely covered by a huge, black drape. He pulled a silk cord and the drape rolled up like a theater curtain.

We hummed our surprise.

There was a railed-in semicircle, inside which stood a swivel chair surrounded by queer controls. A metallic table held a keyboard of typewriterlike buttons and a row of something like pressure gauges. To the left were levers like automobile emergency brakes. On the right were great wheel valves standing upright from horizontal pipes of six-inch diameter.

But in back of this weird grouping of controls was an even stranger sight. A second room made up the full length of this amazing laboratory; an oval-shaped chamber whose walls, ceiling and floor were formed by solid glass two feet thick. This odd room was empty, save for a canvas coverall and a gas mask that lay together with a small oxygen tank in the center of the floor.

"Notice the oval door fitted tight into the front wall of the glass experimental chamber," said Professor Bissell, walking through an opening in the railed semicircle and dropping into the swivel chair. "It permits entry into the room. You will soon know why. However, at this point a little demonstration becomes advisable, before we continue to the main experiment."

THE PROFESSOR threw a great lever, opened the two big wheel valves,

and his fingers flicked over the typewriterlike keyboard.

A hair-raising scream, heard even through the thick walls of the glass room, came to our ears.

Miraculously, it seemed, a thin veil of smoke whirled up from the floor, thickened into strangely colored clouds. Jet-black some were; others were of greenish and purple cast, and mixed with still others that were steamy gray or white. In wild turmoil they were, darting pell-mell over one another, breaking up, now whirling down, now rushing upward; but always close to the oval glass walls. For, whenever cloud gaps momentarily opened, we saw the chamber's center to be a region of undisturbed calm.

Professor Bissell pressed another control key. The whirling clouds instantly leaped into a revolving motion that grew faster and faster. With this change came a deafening roar that grew louder and louder. Can you imagine a tornado's funnel held within a room of glass? The sight and sound were like that.

Suddenly, as though whisked away by a mighty wind—sucked down into floor vents, I later learned—the cyclonic funnel was gone. I stared in amazement. In the center of the oval chamber the canvas suit, mask, and oxygen tank lay quite undisturbed, despite the windy turmoil that had certainly raged around them. Professor Bissell smiled at my bewilderment.

"Yes, they're still there. But I stopped the air pressures just in time to prevent that equipment from vanishing forever. It will be very important to me in a few minutes."

We reporters shot a volley of amazed questions at the professor.

"Gentlemen," he said quietly, rejoining us outside the railed semicircle, "calm yourselves. I shall explain. You see here the greatest vacuum chamber ever made by man. Long ago I realized that ordinary ways of reaching high de-



grees of air exhaustion would never accomplish what I wanted to do: to thin air—which I had come to understand was actually space—to the breaking point.

"So I made this chamber, with all its controls and machinery, to bring about the greatest vacuum ever known. You might call the room a tornadic-vortex; term the machinery an atmospheric pump. Of course, it took the spare time of years to perfect. The electrical pumps and motors, which are really only a modern arrangement of the old-time rain maker's vortex-ring equipment—formerly used in unsuccessful attempts to shake rain out of fogs—are in the basement below. Naturally, my new and special designs of compression and expansion apparatus have added the finishing touches and given me what the oft-ridiculed rain makers so hopefully sought—atmospheric control.

"Of course," continued Professor Bissell, "I have far greater plans than mere rain making, as you shall soon see. By the way, you understand that the instruments within the railing there are but remote controls for the vast mass of machinery below us, do you not?"

"But the rolling masses of clouds we saw——" Jamison gasped. "Where did they come from?"

"That was but chemical smoke fed from an automatic vat in the basement. Its only use is to make compression and expansion of air pressures visible to the eye. Luminous colors of the smoke are but the result of static and kinetic electricity caused by wild air motion."

"Well, well!" I exclaimed. "A tempest in a teacup, all right! Quite a plaything, professor. But what the dickens is the idea behind it?"

"A very important and scientific one, Mr. O'Grady," answered Professor Bissell. "That glass room is actually a laboratory for the artificial creation of

a controlled tornado-vortex, or, more simply, a cyclonic funnel. Why do the walls not break? Because they are double walls, between which is kept up a pressure equal to those within the chamber itself.

"To you, gentlemen, the tornado is a mighty engine of destruction that appears in nature—the deadliest of all storms. But to me, a tornado is a curious grouping of clouds caused by air-space pressures from which forms—and the only time it ever forms—the strange *atmospheric vortex*. Just inside that vortex exists a queer condition: air space enormously rarefied by a centrifugal whirling. *There* is found—I firmly believe this and intend to prove it—a thinning of air space so extreme that space breakdown results in what you might term a complete void, but which I would call an actual doorway to things that must exist beyond space. Through that atmospheric doorway I intend to pass."

I STARED at the queer tornado chamber and shivered. I remembered the appalling roar of winds heard when it had been in action.

And Professor Bissell was going inside that chamber in a fantastic attempt to pass *beyond space*!

Was the scientist mad? Had long years of hard experimentation shattered the sanity of that wonderful brain in that magnificent head?

"Gentlemen," continued Professor Bissell, "do you know that tornadoes have sometimes caught up trees, parts of houses and animals—which vanished completely? And that tornadoes have, on at least four recorded instances, engulfed *human beings who were never seen again*? Where did these objects, animals and people go? Were they blown to bits by the winds' violence, as so many observers have believed? Or were they, assuming that air is space—a thing of which I am certain—flung

into a world almost impenetrable to man, a world beyond air space? I believe the latter theory is true. That is what I intend to prove in to-night's great experiment."

"See here, Professor Bissell," said I indignantly (I had really begun to think him mad) "this thing has gone far enough! With all due respect to your high place in the scientific world, I say that you are foolish to believe that any one can pass beyond space. Why, even if your theory of space breakdown within the tornado were right, you would never live to prove it! A tornado can drive great planks two feet into solid ground! Even a cannon can't do that! And out of your book I quote figures of wind velocity in a tornado: 'seven hundred miles an hour! You couldn't stand in a wind like that and live two seconds!'"

"I don't intend to stand in such a wind."

"But you said——"

"Mr. O'Grady, it is the *outer vortex* of a tornado which causes all the damage to property and life. In the *exact center* of a tornado's funnel all is peace and calm. It is that outer vortex which overturns railroad trains, tears giant bridges from their foundations, carries house roofs for miles. Hitherto, it has been impossible to safely pass into the inner calm of a tornado because, as its funnel speeds along at twenty to thirty miles per hour, the outer vortex is met first.

"But in a stationary, artificially formed tornado that is not the case: the storm funnel can be formed *around one*. Such is the purpose of this experimental chamber. I shall enter it, stand in the exact center. To you, Mr. O'Grady, I give the honor of working the outside controls here—after I fully explain them—so that the giant whirl of air space is caused to form around me. Then, in the calm, undisturbed center of the funnel, air will gradually become so rare

that air-space breakdown will occur. If my theory is correct, I shall then be in a new, absolutely unexplored *world beyond space*."

"It's insane," I declared disgustedly. "Why I can see a hundred flaws in that idea! In the first place, even granting that you will be unhurt in the middle of such violence, there will be no air to breathe!"

"You have indeed a keen brain, Mr. O'Grady," said Professor Bissell calmly. "If you were observant as well, you would have grasped the meaning of the pneumatic suit and mask and the oxygen tank that lies in the center of the chamber floor."

For a moment no one spoke.

JAMISON and the other awe-struck reporters stared, in turn, at Professor Bissell and his tornado chamber. My feelings, I believe, were far different from theirs. With my increasing sense of forthcoming horror and disaster in this experiment, awe was quite displaced by a wild desire to stop the scientist from going through with it.

"Professor Bissell," I argued desperately, "even granted that, safely protected in body and lungs by an oxygen-filled suit, mask, and tank, you enter a world beyond space—something I don't believe possible—you couldn't wander around or explore the place. If you moved away from the spot you went in at, the exact center of the tornado-vortex, it would be impossible to get back!"

Professor Bissell's wide-set eyes stared keenly at me; his huge, gray-haired head bobbed heavily.

"Young man, you are quite right. It is necessary that I note the exact place of my entry into the world beyond space in order to return safely. You are a nimble thinker, Mr. O'Grady. Later, I would like to discuss the prospect of your becoming my assistant in future scientific experiments."

"Oh, no special credit to me, pro-

fessor," I said, and felt myself blushing as red as my hair at his praise. "I got the idea from a science-fiction story. A four-dimensional man traveling in time had to fight back to a certain spot before he could get to his own world."

"Science-fictionists," said Professor Bissell seriously, "are real prophets of the future. We of the laboratory but slowly harden their far-seeing predictions into reality. However, enough of that; we must get on with the experiment."

Professor Bissell explained the tornado controls to me.

Two great levers cut the expansion and compression outfit in and out. The wheel valves regulated flow of air and the chemical smoke. Buttons of the typewriterlike keyboard speeded or slowed the tempo of the atmospheric vortex.

I nodded my full understanding of his explanation. "I will go into the tornado chamber," said Professor Bissell slowly, "put on the canvas air suit and mask, shoulder the oxygen tank, and start the latter to work. At my signal, you, Mr. O'Grady, will begin the vortex pressures and speed them up until I vanish—as I most certainly shall. Then you will stop the machinery, wait fifteen minutes according to the electric clock there on the control table—which I shall also time by the wrist watch I am wearing—then start it up again. I shall reappear from the world that must exist beyond our air space—having made it a point to be at the right spot at the exact time. Then you gentlemen of the press will have something for your papers to print: the story of the strangest scientific exploration ever published."

"Wow! I'll say we will!" wheezed fat Dave Brooks. "What—what kind of a world—do you think it will be, professor?"

A queer gleam came into the scientist's wide-set gray eyes.

"An electrical world, I think. A world where the negative electricity of the electron forms, as the famous Dr. Dirac has pointed out— But, no, that can wait. To explain in detail would take too long. Besides, Dr. Dirac and I may both be mistaken. All I can say now is, I expect such a world to be violently electrical in nature. However, I shall soon know."

"But what about strange hardships, unforeseen dangers, which you may find in that electrical world?" I asked meaningly; for that weird feeling of coming disaster brooded heavily in my brain.

Professor Bissell was unmoved. "I presume you mean the danger of electrocution. Well, in a world where no atmosphere exists, I think that air within my pneumatic outfit will form a sufficient insulator. Anyway, I will have to risk it. But, as a matter of fact, Mr. O'Grady, you, as well as the other gentlemen here, perhaps face a greater danger than I. It is possible that a very wide opening in the spacial insulation between two kinetic electricities of two worlds might— But no!—it is too remote a possibility to talk about. Really, I do not think anything will miscarry."

"But," I said (though I was quite unaware that in the light of coming events there was a significant clue in the scientist's careless words), "I have the darnedest feeling that something will go wrong!"

Professor Bissell smiled. "For a young, red-headed Irishman you are quite a worrier, Mr. O'Grady. Why not think about the wonderful discoveries that I shall certainly make in this hitherto unexplored world?"

"All right, all right—it's your own funeral, professor!" I said resignedly, since the scientist was determined to go through with this fantastic experiment. "I'll do my part with the controls. Good luck!"

JAMISON, Brooks, and Miller opened the round, vaultlike door of the glass room. They closed it behind Professor Bissell. We saw the scientist put on the pneumatic canvas coverall over his blue serge suit. He pulled the mask helmet over his great head, shouldered the oxygen tank. The coverall ballooned with air as he turned tiny tank valves with his gloved hands.

Professor Bissell signaled me to get into the swivel chair and start the machinery.

"I don't like this!" I exclaimed to Jamison. "It's—it's too darn fantastic! Something may go wrong—"

Jamison's sharp features were serious. "I feel funny about the whole thing, too. But go ahead—start the outfit. You're running things now, you know."

I threw levers, turned wheel valves, and pressed keyboard buttons as Professor Bissell had instructed.

An ominous rumble came from the basement machinery below. The glass chamber roared into atmospheric activity. Despite its double walls, air pressure in our outer room was queerly increased. My eardrums ached. An electric-light bulb overhead—one of a dozen that flooded the laboratory with intense white radiance—burst, fell tinkling.

In the tornado room—I know not what else to call it—black chemical smoke appeared, whirled in fury around the oval walls. We could dimly see Professor Bissell—looking like a visitor from another planet in his queer air suit—through the wildly spinning clouds. In the center of the furious atmospheric vortex he stood—a fragile human being amid a tempest!

The laboratory-made tornado increased its roaring fury. Its clouds turned green and purple, were shot through with steamy gray and white. Mingled with their frightful tumult came the rising, falling shriek of a hundred fire sirens, as the storm funnel formed.

Then, faintly, through the dim sounded fat Dave Brooks' yell. "I can't see the professor any more—he's gone! Professor Bissell's gone—"

Hastily I threw levers, spun wheel valves. In a twinkling the synthetic tornado in the experimental room broke up, vanished. Chemical smoke clouds were automatically whisked into floor vents (piped, probably, to basement vats). The oval room was empty.

There was an amazed silence among us reporters.

Then: "My stars—he's gone!" gasped Jamison. "He's really gone—gone beyond space!"

"He's crazy—but splendidly crazy—to take such a chance!" fat Dave Brooks wheezed. "Boys, the professor is a genius, all right! He's done it—the greatest thing any scientist ever did! He's hopped into another world!"

I WAS AWED, strangely elated. What price my queer fears now? Professor Bissell had proved himself and his theories correct.

"Great Scott! What a story we'll have—when he comes back!" I exclaimed, and stared at the electric clock on the control table in front of me. "Let's see, it's fifteen minutes to nine. A quarter-hour wait, fellows—remember, the professor's timing that by his wrist watch, too—and then we'll know all about that *new world*!"

Jamison passed cigarettes. We each took one, lighted up, and smoked away in a tremendous excitement.

But a minute later, Miller, of the Washington *Herald*, a tall, lanky fellow in brown, whistled. "O'Grady," he shot out, "you're sure the outfit is completely shut off?"

"Righto!" I snapped. "And it's not to be started again 'til nine o'clock sharp!"

"Then what causes that flickering white light? Right there—in the center of the chamber—halfway from the floor.



Say! That's around where the professor was last standing!"

I stared. It was a queer thing, all right. At first it was like the far-off flashing of heat lightning. But with horrible swiftness it grew to repeated blasts of flame. Then something very like a Rocky Mountain storm broke in the experimental room—jagged lightnings—thunderous roars.

Suddenly, into the chamber came a blinding ball of white, six feet wide—a sphere that hissed and hummed and seethed with surging electricity. This fire ball wobbled, swayed, and finally burst with an ear-splitting roar.

"My Lord! This shouldn't be!" I yelled, as all my half-forgotten fears of the unknown rushed back. "There's a leak somewhere! That lightning ball swelled out of empty space!"

Fat Dave Brooks was in a panic. "Turn on the outfit, O'Grady! Something's wrong. The professor must be in trouble!"

"Don't be crazy!" I exclaimed, turning in the swivel chair. "We've got to wait until exactly nine o'clock. That was agreed. Why start the machinery if Professor Bissell isn't in the right spot? He couldn't get back, anyway!"

White fire balls, varied now and then by long, glassy tubes of electrical discharge, oozed and expanded from the tiny spot in space—exploded into dazzling brilliance. Between deafening roars the hissing and humming grew louder.

"It's an electric world beyond space, all right!" Jamison yelled. "Look! Now *this* room is filling with current! Yellow and green fire—it's glowing all around us—coming right through the glass walls! O'Grady—your hair is standing on end! So is Brooks'—and Miller's—and Smith's—and mine, too!"

I FOUGHT against terror. The laboratory and the tornado chamber were both an inferno of fiery electricity

now. Amid the glare and roar we stared at each other in horror.

A strong gas with a queer smell began to bite at my nose and throat (I think now that it must have been ozone in huge amounts). I felt a horrible crawling, as of thousands of spiders, over my entire body. My heart pounded. I knew what that slimy crawling meant. Once, standing in the open amid a raging thunderstorm, lightning struck a few feet away from me. I felt, then, that same spidery crawling over my skin. It meant—and any electrical expert will tell you the same thing—the presence of electricity in dangerous volume.

"Start the machine!" wheezed fat Dave Brooks in terror. "Start it up! Get the professor back! Something's wrong! I'm not staying here much longer!"

I stared at the electric clock on the control table. It was five minutes to nine.

"Can't do it, Brooks. I promised Professor Bissell to wait until nine!"

White jets of electric fluids hissed out from the glass room into the laboratory. Our faces were ringed white flame. Our hands and fingers spurted violet brush discharges.

Jamison's necktie caught fire, burned yellow. He and the three others shrieked wildly and ran. A queer electric wind slammed the laboratory door shut behind them.

I was alone—amid an electric hell.

The tornado room was a mass of multicolored fire in which four giant spheres of red ballooned about.

IN THE LABORATORY, blue-white bars of electricity explosively jumped about the walls, ceiling and floor. I choked and coughed as pungent-smelling ozone attacked my lungs.

I don't suppose this next will be believed—but I swear it's true! My hair was singing.

Each strand of my red hair was standing straight up—I could see it reflected in the glass wall in front of me—and, as a violet corona haloed my head, each strand vibrated with a high-pitched trill.

I have since been told that wires on Pike's Peak sometimes sing that way during violent thunderstorms. I will testify that human hair can be made to do the same.

Suddenly a wave of electric pressure—I swear it was an electric wind—threw me two feet in the air. I fell heavily in back of the swivel chair—just inside the pipe railing. Painfully, I arose, found my body racked by electric fluids that seemed to be twisting me inside out. Fighting against panic, I stumbled back to the swivel chair, glanced at the electric clock—which somehow continued to work amid this electric hell—

It was one minute to nine. Never before nor since has time seemed to pass so slowly.

Then came the ominous crackling of fire—actual red fire. With the suddenness of kerosene touched by flame, the laboratory was burning. Waves of heat and smoke redoubled the disruptive effect of the other-world electricity. Faster and faster, electricity swelled out of air space in the glass room, burst through the crystalline walls. The latter no longer had the slightest insulative effect.

In front of me the metallic control table reddened with electric heat. The clock had stopped—smashed by a jagged bar of high-frequency current. Convulsed with pain, tortured by the madness of terror, I writhed in the swivel chair, groaning out the passing seconds.

"Ten—twenty—thirty—" was my agonized count, with fire and electricity increasing as though commanded by a wild demon of destruction. A half minute to nine—I could wait no longer.

With vanishing strength, burning my

hands on their hot metals, I threw the big levers, spun the great wheel valves, tapped feebly at the typewriterlike keyboard. And, despite the electric fury within the glass chamber, black clouds of chemical smoke whirled into funnel form. Then came a mighty roar—a white blaze—

Like a tidal wave, a rolling flood of luminous blue fluids burst the glass walls of the experimental chamber. It was a Niagara of *visible electricity* pouring into the laboratory.

Then came the electric tornado. That's what it *must* have been.

I think that the laboratory exploded *outward*. Anyway, there was an ear-splitting roar and the walls fell like stage scenery. A tremendous electric wind hurled me upward like a feather. I seem to remember spinning head over heels inside the blazing white funnel of an electric tornado that moaned and hissed and swung from side to side as it danced out into the blackness of night.

I swear that I saw—though I am not believed on this point—the dismembered body of Professor Bissell amid the dazzling funnel. First I saw an arm and a leg, bare of cloth, spinning in an upward current of great pressure. Then I saw a great trunkless head, bobbing and dipping amid the blue-white fluids like a pumpkin in waves, before it suddenly vanished.

Then things went black.

JAMISON tells me I was found senseless, half stripped of clothing, in a vacant lot a full mile from Professor Bissell's house. Near by was a battered, twisted oxygen tank—which may or may not have belonged to the ill-fated scientist.

Hospital internes tell me that I have many times over groaned out the entire story of this astounding occurrence. But it was put down to the delirious ravings of a badly injured man.

By common consent the matter has

been hushed up. Its scientific aspects would never have been believed, anyway. Short paragraphs in newspapers spoke of an experiment explosion in Professor Bissell's home laboratory—an explosion that burned down that eminent scientist's dwelling.

Supposedly, Professor Bissell had been blown to bits.

As for the electric tornado, I confess even myself puzzled. No one seems to have seen it. My fellow reporters disbelieve it. They think that I fled in a panic after the explosion. They laugh at the idea that any tornado, seen or unseen, could carry me a mile from Professor Bissell's house and drop me alive.

Nor will they believe that the scientist ever came back from beyond space. That with my own eyes I saw severed parts of Professor Bissell's body whirling aloft within an electrical tornado is ridiculed—for those parts have never been found. As for the bent and twisted oxygen tank in the vacant lot, there is nothing to prove that it once belonged to that luckless scientist.

Yes, this is certainly an astounding story. As to its truth, you will have to take my word in full. Jamison and the others talk of it no longer. They are busy with more practical matters. To them, the ill-starred experiment that night remains as but a more or less mad dream.

To me, Professor Bissell's fateful entrance into the world beyond air space is the most wonderful experience of my life.

To those who might doubt that such a world would show the electrical phenomena I have claimed for it, I point out that recent scientific theories concerning electronic matter would seem to indicate that a sea of negative electricity forms the foundation of the universe. Evidently it is beyond air space that such a foundation lies.

The reader will, no doubt, remember that Professor Bissell himself hinted that an electrical world lay beyond air space.

How did the terrible disaster happen? Well, I can only point out that the scientist uttered a brief and hasty sentence as to the remote possibility of a break in the air-space insulation between two powerful kinetic electricities. That, I think, is just what happened.

However, to martyred Professor Bissell must go the great honor of having first entered a new world.

I shall end with this hope: that some day proof of that world will be verified by scientific research. May others enter and return safely. May my story spur some brilliant experimenter to open wide the path along which Professor Bissell first traveled—traveled at the cost of a life devoted and sacrificed to science.



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# The ISOLINGUALS

*Suppose—just suppose—that the  
pseudopsyché is a piece of ancestral  
memory—that's gotten carried along in  
the germ cells—*

by L. Sprague de Camp

NICK looked at the cop, and the cop looked at Nick. The fruit vendor's friendly smile suddenly froze. The cop didn't know it, but something had gone *ping* inside Nick's head. He wasn't Niccolo Franchetti any longer. He was Decimus Agricola, engineering officer of the good old XXXIIInd Legion. He had been standing behind his ballista, laying it for the Parthians' next charge. Of the crew, only he and two privates had not been struck down by the Asiatics' terrible arrows.

Then something awful had happened: the vast red rock desert of Mesopotamia had vanished, and with it the swirling masses of hostile cavalry, the heaps of dead and wounded, and everything else. One of the ballista crew was gone likewise; the other had metamorphosed into this fat fellow in the tight clothes. His catapult had, in the same twinkling, become a little two-wheeled wagon piled with fruit. He was standing on a paved street, lined with buildings of fantastic height.

Decimus blinked incredulously. Sorcery! Those Parthians were said to be good at it. The man looking at him *must* be Cartoricus, the Gaulish replacement. "*Oneret!*" he shouted. "Load!"

The man in dark blue just stared. Decimus lost his temper. "What's the matter, don't you understand good Latin? They'll be at us again in a minute!" The man did nothing. Decimus felt for his sword. It wasn't there. He was wearing queer, uncomfortable clothes like the other. He snatched an apple; at the touch of it his mind reeled. It felt like a real apple, not a sorcerer's illusion. He bit into it. Then stark terror seized him. He threw the apple at the fat man and started to run.

ARTHUR LINDSLEY picked up the hand set. "Hello? . . . Oh, it's you, Pierre. How's the esteemed son-in-law this morning?"

"Fairish," replied the instrument. "I'm up at Rockfeller Med. Bill Jenkins has a case that might interest you. None of their high-powered psychiatrists have been able to do a thing with it. Want to come up?"

Lindsley looked at his watch. "Let's see—my elementary biology class lets out at two thirty. I can come up then."

"Fine. And could you round up a couple of good linguists and bring 'em along?"

"Huh? What for?"

"Take too long to explain over the





*Calderwood, the mathematician, suddenly wound a tablecloth around his waist and chased everybody with a carving knife.*

'phone. Can you bring them?"

"Well, there's Van Wyck over at Barnard, and Squier's office is down the hall. Say, are you and Elsa going to have Christmas dinner with us?"

"Sorry, but we promised my folks to have it with them this year. Yeah, we're taking the train for Quebec next Thursday. Thanks anyway. Now

please bring some really good language sharks. It might be important."

Professor Lindsley sighed as he hung up. He didn't look forward with much pleasure to the undiluted company of his two sons all day Christmas. Hugh would talk interminably about the vacuum-cleaner business. Malcolm would drape himself over the furniture

and make languid remarks in his newly acquired college voice about how art is all. What did Pierre mean by dragging Elsa off to spend Christmas with his Canuck parents? They were the only intelligent members of the family, besides himself—

LINDSLEY took the new Tenth Avenue Subway up to the Medical Center, with his two linguists in tow. Squier had been in, but not Van Wyck. A search of the language department had unearthed a Dr. Fedor Jevsky, who said he'd be ver-r-ry glad to come. Lindsley was a smallish man, very erect, with snapping eyes and a diminutive white beard. He looked odd, leading the rangy Squier and the obese Jevsky like a couple of puppies.

Dr. Jenkins' office was jammed. The thickset, shabby man was speaking: "It's just like I told the guys down at the hospital, doc; Mrs. Garfinkle and I been married ten years, and she never showed no symptoms or nothin'. We're just poor working people—"

Jenkins' bedside voice suddenly recovered its normal snap. "Come in, Arthur; I take it these are your linguists. I've got a queer job for them."

Pierre Lamarque's broad, coppery face grinned at his father-in-law from across the room. Jenkins was explaining: "—and all at once her normal personality went out like a light. She began talking this gibberish, and didn't know her husband or the city or anything else. That's just the trouble; we can't locate a single physical paranoiac symptom, and aphasia won't work either. Split personality, yes, but it doesn't explain her making up what seems to be a whole new language of her own. But that's not all. She's the third of these cases the hospital has received in twenty-four hours. Sure, naturally we gave 'em all the routine tests."

The telephone rang. "Yes? Oh,

Lord! . . . . Yes. . . . . No. . . . Glad you let me know." Jenkins hung up. "Twelve more cases. Seems to be an epidemic."

Jevsky had inclined his globular form—it was impossible for him to bend—in front of the plain-looking woman on the chair. She seemed to be so earnestly trying to tell him something with that rush of strange syllables. He suddenly seemed to catch something, for he barked at her what sounded like "Hay-bye-ded-yow?"

The rush of sound stopped, and the woman's face broke into a grateful smile. Then the torrent began again.

Jevsky wasn't listening. He spoke to Jenkins, "What foreign languages has Meesez Garfinkle studied?"

"None at all; she was born in New York City; both her parents spoke English, at least of a sort; she left school at the end of the eighth grade. What do you think you've got, Dr. Jevsky?"

"I'm not sure, but it might be Gothic."

"What!"

The vast shoulders shrugged. "I know it sounds crazy, but *habai-dédjou* means 'if I had' in Gothic. I don't really know the language, except for a few fragments like that; nor, I theenk, will many of my colleagues. You, Dr. Squier?"

The other linguist shook his head. "The Celtic languages are my specialty. But I suppose there's at least one Gothic scholar in New York City. There's at least one of everything else."

Jenkins shook his head. "No, gentlemen, it's hardly worth trying to dig one up on such a fantastic hypothesis. Guess we have a new form of dementia here. Sorry I hauled you up; she acted so rational that I thought you might find something. By the way, what is Gothic?"

Squier answered: "The language of the ancient Goths; it's more or less the common ancestor of English, Dutch, and

German. A complicated affair with about nine thousand useless inflections. We have only a partial knowledge of it."

THE TELEPHONE rang again. When Jenkins had hung up, he swore. "More cases. They're coming in regularly now. They've got one who seems to be talking some kind of English dialect, and they're bringing him up here. Suppose you all stick around for a while."

They stood or sat on the floor. Lindsley argued with one of the Rockefeller psychiatrists about politics. The biologist thought Slidell and his so-called Union Party were a real menace, that they were aiming for a dictatorship and were pretty good shots. The psychiatrist didn't; he admitted that Slidell was a fanatical demagogue and all that, but said that if the other parties would stop trying to cut each other's throats they could squash the would-be dictator overnight.

At last the hospital men brought in a slim, blond youth with a harassed expression. Jenkins rose. "I understand you're——"

The young man interrupted. He spoke a peculiar English, rather like a strong Irish brogue. "If thou're going to ask me who I be, like the rest of these knaves, my name is Sergeant Ronald Blake, of the theerd company of Noll Croomle's foot, and a mor-r-rtal enemy of ahl Papists! Now are ye satisfied?"

Squier said, "Whose foot? I mean, how do you spell him?"

The youth frowned. "I'm no clerk, but I bethink me 'tis C-r-o-m-w-e-l-l, Croomle."

Lindsley spoke up, "What year is it?"

"Certainly, 'tis the year of our Lord sixteen forty-eight."

The scientists looked at one another.

Jenkins said, "We seem to be getting somewhere, but I'm not sure just where.

Young man, suppose you tell us just what happened."

"Well, I had gone home on leave, and my wife asked me to go down to the butcher's, and I had just toorned on the main street o' the village when I spied my old friend Hawks. 'Hoy, Ronald,' he says, 'how's the brave soldyer lad? And is't true thou wert at Naseby?' So I began to tell him ahl about the great battle, and how at the end the Cavaliers fled like rabbits, with their long hair streamin' out behind——" The voice from the past, if such it was, rolled on and on. Sergeant Blake was evidently a man who believed in getting in all the details.

LATER, Lindsley and his son-in-law sat in the former's office. Tobacco smoke crawled bluey up through the rays of the desk lamp.

"Something's gone haywire," said the professor. "I can't believe this is an ordinary form of insanity, or any extraordinary form, either. How can you explain how Mike Watrous, package dispatcher at a department store, a young man of little learning and few talents, not only gets the idea that he's a sergeant in the Parliamentary army in the English Civil War, but also acquires a complete biography, personality, and accent to go with it? How many literate people, let alone those of Mike's background and tastes, know that Oliver Cromwell pronounced his name 'Croomle'? In most cases of this kind the victim thinks he's Napoleon or Julius Caesar, but after the delusion has come on he doesn't know any more about Napoleon or Caesar, really, than he did before."

Lamarque shrugged. "Any other hypothesis I can think of seems equally crazy, unless you're going to admit the transmigration of souls, or some such nonsense. Suppose I caught this disease, or whatever it is, and thought I was the first Lamarque, who came over

to Canada in 1746, or thereabouts. I wouldn't have the vaguest idea of how to go about talking eighteenth-century French."

Lindsley sighed. "And now they want us to drop everything we're doing and try to help them out. I wish they made these psychiatrists—and that includes our friend Jenkins—learn enough advanced biology so they wouldn't come running to us when they get stumped. But I suppose we'll have to go through the motions, anyway. The worst of it is that I haven't the foggiest notion of where to start——"

HANS RUMPEL was making a speech. He was in fine form. His Yorktown audience drank in his flood of words, his piercing yells, his wind-mill gestures. "Red plot. . . . Jewish assassins. . . . Destruction of civilization——" he screeched.

Hans faltered; his oratory died away to a mumble. His audience was mildly surprised to see him going through the motions of stroking an imaginary beard. Then his voice rose again, this time not in English, but in mournful Hebrew. He was, in fact, reciting a Hebrew service, just as he—not Hans Rumpel, but Levi ben Eliezar, a respected rabbi of the Hasidim—had been reciting it in a Krakow synagogue in the year 1784. The would-be saviors of civilization from the horrors of democratic government looked at one another. Was he another of those cases they had been reading about? Hans stopped his chant, gaped at his audience, and fell on his knees. He was praying with mountain-moving fervor——

PROFESSOR LINDSLEY emerged from behind the tarn of books and papers and threw his eye shade in the corner. "Pierre! Let's cut this damn nonsense and get some breakfast. It's seven o'clock."

Lamarque appeared. "Any luck? None here, either. Can't find anything definite, although Minakuchi's paper on ancestral memory in rats might be worth following up."

Lindsley frowned. "Something you said the day before yesterday gave me an idea, but it popped out of my mind like a watermelon seed, before I could grab it. I've been trying to think of it ever since. Must be getting old."

Later, Lamarque made a face. "With all the advances in our modern civilization, nobody has yet found how to make a drug store serve good coffee. Oh, remind me to wire Quebec and tell the folks the Christmas dinner is off. What's the latest from Jenkins?"

"More of the same. At the present rate every hospital in New York will be full in a couple of days, and all the medicos in town are running around in circles, and the psychiatrists are just dithering. Bill says they're fairly sure it isn't infectious, from what case histories they've been able to trace. And we aren't any further than when we started——"

SUNDAY, in the new church on Tremont Avenue, the Bronx, H. Perkins rolled his eyes around so that he could see the congregation. Pretty miserable showing. Why had the vestry wanted to build this church, anyway? He'd heard a lot about the "return to religion" since 1950, but they didn't seem to be returning to *his* denomination. Such a worried-looking lot, too! Between the threat of a dictatorship by that bellowing mounteback, Slidell, and the strange plague of insanity, he didn't wonder. What would happen if Slidell got in?

H. Perkins passed down the aisle with his most seraphic expression. The "plate"—a most unplatelike object, when you thought of it—was coming toward him again, giving forth a pleasant



clink as each coin went into it. He reached over and took it from Mrs. Dinwiddie—and it was as though meek H. Perkins had never been. He, Joshua Hardy, had been standing on a heaving deck yelling to the verminous crew the commands from "Old Pegleg." They'd just sighted a Spaniard, and were cracking on sail to have a closer look. Might be the monthly treasure ship from Colon. And here he was, in the aisle of a church, surrounded by people in strange clothes, and holding a little velvet bag with two dark wood handles.

Josh was too impulsive to make a really top-notch pirate. He shook the bag; to his ears came that sweetest of sounds, the clink of coin. Better grab the loot and run, boys. "Avast, ye lubbers," he roared. "Give me that!" He snatched the other little bag. "Ho, you over there, stand and deliver! *Where* in fifteen thousand bloody hells is my cutlass?" He raced down the aisle to cut off the fellow with the remaining bag. Too late! The chase pounded out into the street—

PROFESSOR LINDSLEY slammed down his brief case. "I'm about ready to give up and go in for the transmigration of souls after all," he said wrathfully to Lamarque, who was peering into a microscope. On the microscope slide was a bit of nerve tissue of one of the cases who had gotten himself killed by an automobile.

Lindsley continued: "They're going to start a concentration camp for new cases, as every institution for miles around is full. The roads leading out of New York are jammed; people are leaving. Glad we sent our women folks off to Quebec while you could still buy transportation. A driver of a Madison Avenue bus had a seizure and ran his bus into a hydrant between Fifty-third and Fifty-fourth Streets. What's new around here?"

"If you mean research, nothing. But

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the first case in the university faculty has happened."

"Huh? Tell me about it, quick!"

"It was in the lunch room. You know Calderwood, the mathematician? As sane and sober a man as you'll find. Well, at lunch to-day he jumped up with a howl and began throwing things. Then he got into the kitchen and chased everybody out with a carving knife.

"But the best part happened next. Some of them watched him around a corner. He marched into the dining room, took off his pants, pulled a tablecloth off one of the tables, and wound it around his waist like a skirt. Then he stuck the knife through one of his garters.

"He must have been a sketch. Wish I'd been there to see. He strutted up and down for a while, apparently challenging the people, in his own lingo, to come back and fight.

"Well, our friend Squier heard the fuss and came up. Squier had a bright idea. He talked Gaelic to Calderwood, and he calmed down right away. Seems he wasn't Graham Calderwood any more, but the terrible Gavin MacTaggart, a wild Highlander looking for a MacDonald throat to cut. If he couldn't have a MacDonald, a Gordon would do. They got him rounded up eventually."

Lindsley took off his glasses and rubbed his red-rimmed eyes. "You're an unfeeling young devil. How'd you like to be a member of poor Graham's family? Did you see about my classes?"

"Yeah. One of your students in advanced biology is down too! Arne Holmgren. Know him? He thinks he's a Viking. When they took him away he was roaring some early Scandinavian battle-song; at least, that's what I suppose it was. Say, hadn't you better get some sleep? You can't work efficiently if you don't, you know."

Lindsley started to snap back an

irritated reply, but checked himself. "Maybe you're right, Pierre. When my normally saintly disposition starts to go sour there's something wrong. If anybody 'phones, tell 'em you don't know when I'll be back."

CHASE BURGE lay on his back with his eyes closed, enjoying the last moment of his doze. His conscience, which woke up a little more slowly than the rest of him, showed signs of stirring. He shouldn't have lost his temper yesterday in that argument. But, damn it, Hobart was so rabid on the subject.

Then he sat up suddenly, the last vapors of sleep gone from his brain. How had he gotten into this strange room? He'd gone to bed perfectly sober. He'd been snatched! He sprang from the bed.

The door opened and a man in a dressing gown walked into the room. Chase tensed himself to spring; but, no, the man might have a gun. Better find out what it was all about.

"Morning, son," said the kidnaper. "I think one of my shirts strayed into your bureau——"

"Where am I?" snarled Chase.

"Where—— Oh, my Lord!" The gray-haired man looked at him with a horrified expression. "You've got it, too!"

"Got what? What did you kidnap me for? My folks haven't any dough to speak of!"

The other man composed himself with an effort. "Who do you think you are? No, I mean that as a serious question."

"I'm Chase Burge, of 351 West 55th Street, and I demonstrate automobiles for a living. Who are you?"

"I'm Chase Burge. Senior, that is. You're Chase Burge, Junior, and I'm your father."

"No, you're not. My father's dead, and he didn't look like you anyway. Is

this a funny way of adopting me, or what?"

Chase Burge, Senior, sat down with a perplexed expression. "Let me explain. You just think you're me. But you're really me—no, I mean you're you. You're your own son, really; that is, you're the son of the man you think you are, but who is really me. Oh dear, I wish I could explain! It's this way: you're suffering a delusion that you're your own father——"

Chase interrupted. "You sound like something out of Gilbert and Sullivan. If anybody has delusions around here it's—uk!" His hand had touched his chin. In a flash he was at the mirror.

"Holy Moses, where did I get this D'Artagnan effect? Have I been unconscious long?"

"Why, you've been wearing that goatee for five years. Lots of the young men wear them."

Chase Burge, Junior, began to laugh hysterically. "Oh, Lord, I guess I am crazy! I know; this is a loony bin that I've been shut up in. I'm crazy, and so are you, unless you're one of the keepers."

PIERRE LAMARQUE threw down his brief case. "I think I have something, but I'm not sure."

"Let's have it, quick!" barked Linsley.

"Let me begin at the beginning. I was down at the hospital looking over the new cases. They had one who they said was an Englishman of about 1300. I couldn't understand him at all, never realized how fast the language changes. He told us we were a 'pock of foals,' which didn't make much sense, until a professor told me it meant 'pack of fools.'

"But the prize exhibit was one of the new cases from out of town—a Mrs. Rhodes of White Plains. They told me she was—or had been—one of the out-

standing uplifters of her community; during the revival of prohibition agitation twelve years ago she was one of the leading lights in the movement.

"Well, you ought to see her now! She chatters in Renaissance Italian, and slinks around with a snaky glide you wouldn't believe possible for a lady prohibitionist in her forties. She'd made a dead set for all the doctors in the place, until they're scared to be alone with her. Says she's Elena della Colleoni.

"That gave me an idea, so I stopped in at the library, and found that there really was such a person as Elena della Colleoni." Lamarque grinned wickedly. "She was a notorious strumpet at the court of Cesare Borgia."

Lindsley polished his glasses slowly. Lamarque knew that meant an idea coming, and kept still.

"I—think—I—begin—to see," said the older biologist. "First, the cases, when we catch them, all act scared to death, but otherwise perfectly sane, ex-



*His catapult had—in the same twinkling—become a little two-wheeled wagon piled with fruit.*

cept that they've acquired the personality of some one, real or imaginary, who lived before them.

"Secondly, the pseudopsyché is always an individual who might conceivably have been the case's direct ancestor, as in the case of the redcap over in the Jersey Heights Terminal who thought he was a Zulu warrior and tried to use a traveler's umbrella as an assagai. Sometimes the descent would be difficult to trace, as in the case of Mrs. Rhodes-Colleoni, but you go back enough generations and you could be almost anybody's descendant. In one case—that of the young man who thought he was his own father—we know the phylogenetic relationship of the case and its pseudopsyché for a fact.

"Thirdly, in at least some cases, and conceivably in all, the pseudopsyché corresponds to a person who really lived."

"But," objected Lamarque, "if they are real, how come the fact hasn't been noted before this?"

"Hm-m-m. Well, consider the ratio between the total number of people who've lived in the last couple of millennia and the number who were prominent enough to leave a historical record of their doings. You'll see how small the chances are of turning up any big shots.

"Fourthly, the average age of the pseudopsyché is around thirty. That doesn't prove anything by itself. Jerry Plotnik's revising the average to include the latest data now. But the age figures are much too closely grouped for a random distribution: no children, and hardly any elderly people.

"Now suppose—just suppose—that the pseudopsyché is a piece of ancestral memory that's gotten carried along in the germ cells, like a piece of ultra-microscopic motion-picture film, and suppose that something happens to substitute this carried-over memory for the case's

real one. You'd think you're the ancestor whose memory you've been carrying around. For obvious reasons, it would end at a point before the time when the said ancestor's child from whom you're descended was conceived. Suppose we call the phenomenon genotropism. That's not a very good name, but it'll do until I think of a better one."

Lamarque whistled. "I hope if it happens to me that I'll be one of my French ancestors and not one of my aboriginal ones. I might be sort of unmanageable as an Ojibway Indian. But say, won't this knock Weismann's theory into a cocked hat?"

"If it's correct, it'll do worse than that. I'll have to eat what I've been saying for thirty years about Lamarkism's being a zombie among evolutionary theories. But remember, this idea of ours is still just an idea, and we haven't any *positive* evidence whatever yet. More than one scientist has been caught because he assumed that because a theory of his *might* account for certain facts, it therefore *was* the explanation."

"Uh-huh, I get you. But now that we have your theory, what are we going to do with it?"

"Damned if I know," said Lindsley, reaching for his pipe.

THE MANAGER of the "Venus" looked gloomily at his audience, if you could call it that. Everybody who could scrape up the price of a fare was trying to get out of town, and the rest weren't spending much on entertainment. You didn't feel safe on the streets any more. Still, burlesque was holding up better than any other form of entertainment; a lot of the movie places had closed. Then, too, a merciful providence had decreed that two of the "Venus'" biggest creditors should come down with the plague.

Betty Fiorelli was working up to the climax of her strip tease. A few more



grinds and bumps, and more clothing had gone into the wings. He'd told her to give 'em the works. The cops weren't likely to send an inspector around at a time like this. A faint "Ah-h-h!" from the audience. But what was the girl up to? Instead of sidling coyly into the wings, she was standing squarely facing the audience, and her rich voice rolled out in verse after sonorous verse of classic Greek, which was just that to her hearers.

Three minutes later the few strollers on 42nd Street gaped incredulously at the sight of a tall and well-made young woman, clad—precisely—in a pair of high-heeled shoes, speeding like an arrow along the sidewalk, while after her panted the manager of the "Venus" and three stage hands. They knew not that they pursued, not Betty Fiorelli, but Thea Tisimicles, the great poetess of Lemnos, whose contemporaries (of the Fifth Century B. C.) thought she surpassed even Sappho.

THE fishy-eyed man was talking earnestly to Professor Lindsley: "O. K., but I think you scientific guys are nuts for not getting out while the getting's good. You can stay until we pull out the inner police cordon, and then out you go. There's no use keeping the cordon there when the gangs of isolinguals have begun turning up all over New Joisey and Westchester. What does 'isolingual' mean, anyway?"

"It means they speak the same language. You can see how it is. A case speaks Anglo-Saxon, say. He wanders around until he runs into somebody else who speaks Anglo-Saxon, and they join up for purposes of offense and defense. Pretty soon you have a gang. Come in, Jerry. Dr. Plotnik, Detective Inspector Monahan. Dr. Plotnik's been helping us with the mathematical side of our research."

"You mean he's one of these lightning calculators?"

"Whoop! You'll insult him. He's a mathematical genius, which is something else."

The detective applied another match to his cigar. "Something's fishy about this whole business."

Plotnik gave a sort of gurgle. "You're telling us?"

"No, sonny, I didn't just mean the disease. The National Patriots have been showing all kinds of activity. We've been getting reports from the police all over the country. A lot of them have been filtering into New York, when everybody else is trying to get out. We've caught a few trying to get through the cordons. And the big bug who owns 'em, Slidell, has disappeared."

"What!" exclaimed Lindsley.

"Yeah. You ain't read about it in the papers, because they all been too busy with the plague. But it looks to me—it almost looks—as if there might be a human origin to it."

"But how?" Plotnik stopped.

"I dunno. Maybe they poisoned the water. Thought I'd take a little run down below the cordon and see if we couldn't catch one of these tough babies that Slidell's been sending around to beat up people he don't like. Maybe we could find out why they ain't afraid of the plague. Like to come along?"

Plotnik stood up, almost upsetting his chair. "You get Pierre Lamarque to go instead of me; I just had an idea that'll take a little time to work out."

SNOWFLAKES glided slantwise out of a gray January sky. "Better park here," said the detective, as Lindsley swung his car off Broadway at 72nd Street. "Won't do to go too far downtown. Look, there's another!"

Lindsley and Lamarque peered through the windows, and saw a hurrying figure slip into a doorway. There was something odd about the figure.

Lamarque spoke: "He's wearing a football helmet!"

"Huh?" said the detective, blinking. "Well, anyways, we're gonna take a closer look at his fancy headpiece. Got your guns, you two?" He slid out of the car, skidded a little on the snow, and steadied himself.

"Town's sure gonna get buried in snow, with nobody to remove it. Keep your eyes peeled for the isos."

The three marched abreast along the deserted street. Professor Lindsley almost stumbled over a body, half buried in the snow. He recognized a State trooper's uniform. He looked about, squinting against the snowflakes, and realized that the half dozen other darkish humps in the snow were also corpses. "Say, Monahan——"

"Sh-h! Want our friend to hear you? Now, Professor Lamarque, you stand on this side of the doorway and tackle him in the legs when he comes out. I'll do the rest."

Lamarque had given up trying to explain that he wasn't a full professor. Moreover, unless something was done about the plague soon, it looked as though he never *would* be a full professor. The university buildings were deserted save for a few dauntless scientists still trying to get at the cause and cure of the affliction.

"Remember," Monahan was whispering, "the foist guy that shows a sign of going nutty, one of the others taps him on the head, but gentlelike, see? We don't want no fractured skulls." He flipped his blackjack up and down to illustrate "genilelike."

The black outline of a man, weaving slowly along the sidewalk, materialized out of the snowflakes. He came up to the ambushade, saying something in a pleading whine.

"Naw, scram, you!" hissed the detective, flipping his blackjack suggestively.

The man scrambled.

Lindsley looked nervously up and down the street, and at the two younger men beside the doorway. Damn it, he'd been a fool to come! Guerrilla warfare was no occupation for a sixty-year-old biology professor. He'd partly brought it on himself, by being the only man to present a plausible theory to the authorities—well, at least as plausible as any others. With New York City practically lost to civilized control they'd have listened to anybody. At the present rate, in another month New England and the Middle Atlantic States would be a wilderness, inhabited solely by roving bands of isolinguals who battled each other with clubs, rocks, and the loot of hardware stores.

Suppose some of them came along now? Thinking that they had been translated by magic into a strange and terrifying world, they were as dangerous as wild beasts. Lindsley wondered what it was like to shoot a man. And then the door opened and the man in the football helmet came out.

Lamarque tackled the fellow neatly below the knees. He got out one yell before the detective was all over him, kneeling on his ribs and stuffing snow in his mouth. Then Monahan yanked off the helmet and slapped the man's skull with his blackjack.

"Come on!" he snapped, getting up and dragging the body by the coat collar toward the car.

A cluster of figures loomed out of the semidarkness. Lindsley counted six—no, seven, and felt in his pocket for the pistol. The seven just stared. Monahan brought out *his* pistol. The seven gave back apprehensively. Evidently they'd had painful experience—perhaps in the Battle of Herald Square, when a National Guard detachment and a troop of State police had scattered a horde of embattled isolinguals, only to be seized themselves, many of them, and start killing each other.

One of the seven spoke up in what

sounded like a Slavonic tongue. The detective tried to smile sweetly. "Can't understand you," he said, wagging his head. The leader's sigh was audible above the hiss of the falling flakes, and the seven trudged off.

The detectives stuffed their captive into the car. Lindsley let in the clutch slowly; the right rear wheel spun a few revolutions and then gripped the snow.

Monahan yelled in his ear, "Step on it, doc!"

Lindsley jumped and tried to comply. In the mirror he had a glimpse of people swarming out of the doorway. A submachine gun crackled; a hole the diameter of a finger appeared in the windshield, surrounded by a spider web of cracks. Lindsley heard a gasp from the captive, and a stream of profanity from Monahan. "They got our prisoner, the——"

The car slithered around the corner of West End and 72nd. "Damn good thing this wasn't an old front-engined car," the rasping voice continued. "They'd have let daylight into us sure. Bet the rear end looks like a gravel sizer. Take it easy, doc; they can't see to shoot more'n a block or two."

LATER Monahan said, "Nope, the stiff didn't have no papers on him, but I still think he's a National Patriot. How you coming along with those helmets?"

"All finished," replied Lindsley. "I've been standing over the analysts with a club for twenty-four hours. The shielding inside the helmet was a lead-bismuth-antimony alloy, with traces of platinum and two of the rare metals. My son-in-law's gone out to wire the specifications to Albany and Washington."

"Hope it ain't too late. We better clear out to-night, before any more of us come down with the plague."

"There's still one telephone wire open," continued Lindsley. "And the

man I was talking to told me the first case has been reported from San Francisco. A scrub lady started doing a hula. Must be a Polynesian sailor in her family tree somewhere. I—ah——" The voice trailed off. Professor Arthur Lindsley was asleep.

A LURCH and the clash of metal on metal awoke him. "Hey, what——"

The detective's heroic cursing left off. "You hurt? Guess we're all right. Hey, Joe, where the hell are we? Poughkeepsie? We're on our way to Albany, professor, or rather we *was* on our way before that truck pushed us into this here lamp-post. Guess it was a case driving, from the way he weaved. Maybe I should 'a' tried to hunt up a 'plane."

Lamarque's voice came out of the dark: "Looks as if there's been another battle, from the corpses scattered around. Will that left door still open? Say, Monahan, don't you ever sleep?"

"Yeah, I grab a little now and then. Come on."

The drug store's shattered front gaped at them with a defeated air. Inside, the detective's flashlight dug a pallid clerk out from behind the soda fountain. "Don't shoot, please!" he quavered. "You're not isolinguals? A gang of 'em took over the town yesterday, and then this evening a bigger gang came along and drove 'em out. I thought they'd all gone and came down to open up shop, but some more came along just now. Look, quick, there they are again!"

"Stand back there!" roared Monahan. The figure in the doorway shouted something back, and the detective's pistol went off.

"Quick, you guys, pile the——" But the two scientists and the other cop were already furiously building a barricade of chairs and tables. A few stones sailed past their heads and made beautiful crashes among the glassware.

Lindsley peered over the top of the upturned table. A figure, wild in the moonlight, rose from the sidewalk and raised a length of pipe or something. Lindsley fumbled for his pistol. Where the devil was the safety catch on the thing? He pulled the trigger. As his senses cleared after the flash and report, he saw that the figure was still there. He gripped the gun in both hands and tried again. The figure doubled over and went *ftthup!* in the slush.

Hours later Lamarque wiped his mouth on his sleeve. "If I drink another malted milk I'll get indigestion. What else have you, Mr. Bloom?"

"Sorry, sir, but the isos cleaned out all the pies and bread and things. And the gas is shut off, so I can't make any coffee. It'll have to be sodas or nothing, unless you want to try some cough drops."

"Ugh! Any luck on the 'phone, Joe?"

"Nope. Unless somebody finds us by dark it'll be just tough. They're waiting for that to rush us."

Unless somebody found them— There wouldn't be any street lights to shoot by. And four pistols wouldn't stop the horde of isolinguals waiting out of sight around the corners.

Darkness—no moon this time. The voices of the isos wafted into the drug store. The leaders were evidently haranguing their men. Then there was a full-throated yell, and the slopping of many feet in the slush. Bloom, the clerk, was carefully setting a row of bottles on the floor to use as missiles. If you didn't have a gun you had to use something.

Lamarque's pistol cracked. "Got one!"

Then the fusillade. But they came on in a solid mass. Lindsley thought, "These are really good, honest citizens I'm shooting, except for their malady." He realized that he had been squeezing the trigger of an empty gun. How the devil did you load the things? He'd

never get it figured out before they swarmed in and finished them off. They were almost in the drug store now—

Monahan stopped his target practice to say, "Now why the hell are they all running one way? What's that noise? If it's a machine gun, boy, we're saved!"

Lindsley never imagined he'd find that implacable hammering the sweetest of sounds. The armored car skidded to a stop, and two football-helmeted soldiers jumped out.

Monahan turned to Lamarque. "What's that? Sorry, but I didn't get you. What? *Hey!*" He flung his arms around the young biologist in a bearlike hug. "Soldier! You got any more helmets?"

Lamarque's muttering rose to a frenzied shriek.

"Yeah, they're in the truck."

"*What* truck?"

"They were right behind us; ought to be along any— Yeah, here they come."

"Well, get one, quick! This guy's gone screwy like the others!"

When the helmet had been forced on Lamarque's unwilling head, Monahan rubbed his shins. "Lord, professor, I didn't know you was that strong. I guess the guy you toined into never loined no Queensbury rules or nothing. But you shouldn't have tried to bite me."

Lamarque was acutely embarrassed. "I—I'm sorry. You know I haven't any recollection of the past few minutes at all, up to the time you put the helmet on me—"

"S all right; it wasn't your fault. Now let's find some of the isos we winged and put helmets on them. . . ."

FORTY-EIGHT HOURS later, Lindsley rubbed his eyes. "What do you mean by waking me up at this time of day, you young scoundrel? Oh, the paper. What's the news, quick?"

Lamarque seated himself on the bed



with his slightly satanic grin. "You guessed right. They sent the army down to surround the area we figured the radiations were coming from, or rather that Plotnik figured they were coming from by finding the mass center of the locations of the cases reported. They were all wearing our cute little helmets, so the radiations didn't affect them.

"When they closed in and started searching houses they rounded up several thousand National Patriots. There was a little shooting, but most of the N. P.'s surrendered quietly enough when they saw what they were up against.

"The military located the cause of the whole works in an old house on Christopher Street. The place was full of radio apparatus from cellar to roof. They found Slidell himself, and his master mind, a Dr. Falk, whom nobody ever heard of, but who modestly describes himself as the greatest scientist of the age. Maybe he's right.

"This Falk got scared when he saw bayonets pointed at his stomach, and let out the whole story. Seems he found a complicated combination of harmonics on a long radio wave that would work this ancestral-memory switch, and he and Slidell figured to disorganize the whole country with it. And when his

broadcasting set was turned off and everybody became himself again, we'd find Slidell installed as dictator and the N. P.'s running everything. Of course, in the meantime they'd be wearing the helmets and would be shielded from the radiations.

"The army turned the thing off right away, and all our medieval knights and yeomen are now ordinary citizens, and busy picking up the pieces. Slidell, of course, made a speech. Too bad there wasn't a stenographer there to record it. I suppose he and Falk will be shot for murder, treason, and every other crime on the books, though I think they could plead insanity with some justice.

"Oh, yes, you're now the head of the department, and I'm a full professor. Also, we're famous, and are about to be intensively photographed and interviewed."

Lindsley scratched his diminutive beard. "Seems to me, Pierre, that we're getting away with murder. Plotnik really figured out the source of those radiations, and Monahan had the idea of suspecting the N. P.'s and setting out to catch one."

"Don't worry about them. They're getting their share of the glory."

"I suppose so. But right now what I want is a vacation from all scientific thought."

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*Ingersoll*



# SUPER-FAST EYES

*A science article*

by Thomas Calvert McClary

**W**AR—  
A long-range shell whined over the great city. It landed in the park, kicked a spurt of dust, exploded like a firecracker.

The explosion did not disturb a man leaning over a fountain. The man on the bench did not move his newspaper. A young couple did not break their embrace. A dog sniffed a hydrant. He did not move when a bird plopped down beside him.

Cold horror gripped the city. Each shell wrought its toll of death. Men's bodies were not blown apart. The slaughter was more horrible than that. With the blood still warm in their flesh, the very rhythm of their bodies, their nerve systems, were shattered!

"An advance type of turpenite!" said the chief munitions scientist. "It is like an organ note that can wreck a building."

"But you could manufacture a shield of static or a counter vibration?" the general asked tautly.

The scientists shook their heads. Not until they could see how the nervous system responded, watch actual nerve reactions. As yet, there was no mechanical eye fast enough to catch reactions.

THE BROAD VALLEY lay lush and fertile under the summer sun, but the faces of the people were gray and gaunt and lined with grief. One tenth of the male population had died already. Others choked violently and rotted within hard, muscular bodies. And now,

this late, they learned it was not silicosis, but a microbe already living within the bodies of all males on earth. Some unknown conditions had brought this latent tribe of microbes into furious multiplication, made of a harmless, latent tribe of germs a ravenous, tissue-rending army.

Then why not kill off this carnivorous microbe?

How? Attempts to find the right antitoxins were being pushed. But the microbes had never been seen. Minute in size, there was the added complication that they were born and lived and died in split seconds. Their nature and habits could only be guessed from their trail of ravaged muscles and flesh and bone.

Yet a mechanical eye of sufficient speed would enable science to study the dread army, bring it under control.

THE governor's committee studied the graphs and charts. It seemed impossible. Probably the sinking of Atlantis (admitting its existence) seemed as impossible to the ancients. The meteorologist pointed to the record of pressure areas of recent years. The governor looked up appalled.

"Forty below zero!" he echoed hollowly. "It would ruin the State. It would drive off winter residents—more, our people would starve. Two billion dollars' worth of damage would be done."

The meteorologist nodded gloomily. "Worse, such extreme cold coming in contact with our warm local conditions will set up hurricanes like none seen



*The slaughter was horrible—with the blood still warm in their flesh, the very rhythm of their bodies, their nerve systems, were shattered!*

since the Great Flood. It is possible the entire lower end of the State may be blown away."

"Can nothing be done to avert the cold wave?"

"With enough atomic power we might build a pressure dome to stand the cold wave off, possibly to thaw it out at sea. In the sun's chromosphere, the calcium atom juggles around its loose electron about 20,000 times per second. When we have some record of just how that electron bobs around, then we can think of building atomic power houses

on such a scale. Up to now, nobody has ever caught a picture of an atom or electron."

THE greatest scientist on skin and glandular diseases sent for the leading physicist.

"I have found," he said reverently, "the fountain of youth! I cannot make man live longer than his originally allotted years. But I can keep him young that long. Leprosy, tuberculosis, cancer, can be controlled!"

The physicist looked wistfully at his

own dried, lifeless skin, the signs of aging arteries, his gnarled and stiff fingers. "Why do you need me?"

"We need radium in quantity. For cancer treatment alone, we need five hundred times the world's known supply."

The physicist thought enviously of transmutation within the stars. "I have a theory," he said. "It is proven in the laboratory, but at prohibitive cost. I can make radium from silver. But I cannot make it cheaply enough until I can see what happens in atomic collisions. As yet, science has no eye fast enough."

A LEADING steel magnate looked at two pieces of alloy and then at his chief chemist. "Different?"

"They have the same element composition. We sell them for the same product. One is ten times stronger than finest steel, the other a mere rustless stripping. The former is a freak. It occurs and we have no idea how. They are made the same way."

"Manufacturing variables?"

"The humidity and the current in the mixers. Both very slight. In small runs there is never a variation in the alloy. The big runs cost forty thousand dollars each. It might take fifty millions to find out if the humidity or current are the cause of the peculiar crystallization in the alloy."

"Can't you study the crystals in formation?"

The chemist grinned. "The crystallizing passes through 17 stages in less than 1/500th of a second. In slower cooling, the crystallization is different. I can't see that fast. Neither can science."

THESE INCIDENTS have not happened. But they are not in some purely imaginary future. They *could* happen to-morrow.

Turpenite is an existent war secret, known to be effective at twenty yards. Our bodies, the earth, is filled with mi-

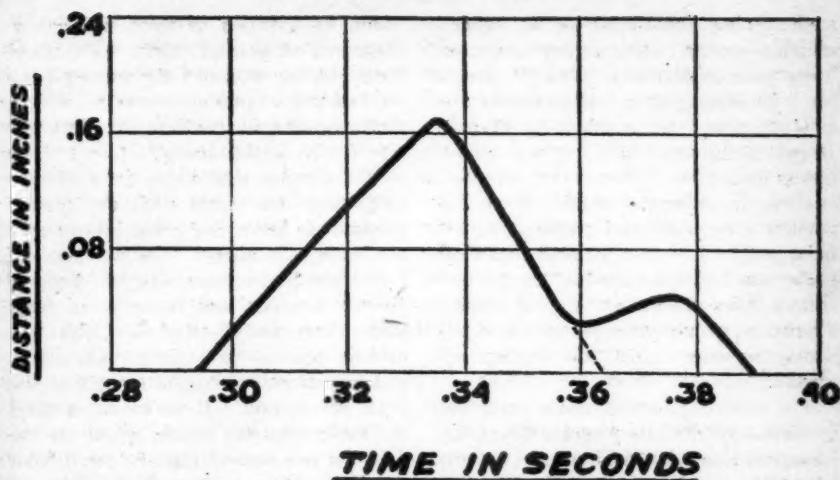
nute and potentially effective microbes living full life spans in split seconds. The physicist's and astrologist's dream is to see pictures of atoms in action. Remember, present photographs of atoms and electrons are but photographs of a trail—the effect of electrons upon surrounding emulsions. When we can get actual moving pictures of what those atoms are up to and how they behave, then transmutation of metals and a deeper understanding of the cosmos will not be far off. And we are headed in that direction.

It is immediately necessary to qualify. It would seem that the 2 necessary components for a study of exceedingly minute and exceeding fast phenomena are the high-powered microscope and the ultra-high-speed movie camera. One increases size to meet the limitations of the human eye, the other slows down time for human perusal.

But it so happens that the two mechanisms work away from each other. Necessary light for microscopic work is the square of the power. Necessary light for ultra-high-speed photography is the square of the speed. When you make the light necessary for a combined operation it is liable to be hot enough to fry the sturdiest microbe, or excite the most lethargic atom, in faster time than it can be "shot." But there has been one benefit to this basic hindrance. It has left the fields of microphotography and ultra-high-speed moving pictures largely independent, and specialization during this initial stage has borne great fruit. High-powered microscopes far in advance of most present needs can already be manufactured and steady progress toward "cold lighting" is in the offing. This paper is limited to discussion of ultra-high-speed movie work, which is the time element.

We are all familiar with the ordinary theatrical slow-motion pictures such as show a racing stroke slowed down so that we can study the movement. The





pictures are made by photographing at a high speed, or more exposures per second, and then projecting at ordinary speed. What we witness is between 5 and 10 exposures of the same period of motion which, at ordinary movie-photographing speed, we would see as one exposure.

It is an analysis of motion, breaking it up into smaller time periods and seeing how it works. The super-high-speed movie camera accomplishes the same thing, except at far greater speeds. If a picture is being made of a bird, it shows not simply one exposure of a wing on the up-beat, and the next exposure on the down-beat, but five or ten or possibly a hundred exposures taken at various stages of each up and down beat.

Until very recently it has been used chiefly for study of mechanical movement, but reduced cost of more efficient film has extended its use within recent months. We can say now that we truly stand on the threshold of a vast medium for analyzing time and motion. The camera is being used to study the mixing of gases and fumes; to study the action of molten glass and metals; to study the exact time factors of high-speed

mechanism; and to break down into individual pictures certain phenomena of electronics such as the explosion of a spark.

The high-speed moving picture has grown up since Sir Francis Jenkins first began experimenting. During his early tests, a tremendous pressure was placed on the film by the speed of acceleration. It was decided that this high-pressure film hitting the bottom of a container would bounce, so the take-up container and reel were eliminated and the film dropped through a hole in the movie machine onto the floor.

At least, that was the intent. The goal, then, was 400 frames per second. The mechanism was started. There was a screech, a crash; the room shook. The air was clouded with pulverized plaster. The film had leaped clean through the hole and demolished a section of wall fifteen feet away! That gives a small idea of pressures which had to be controlled.

IN THE DAYS of the old nickel-odeon, theatrical movie folk produced varying degrees of slow-motion pictures and did some small research to overcome

such timing inconvenience as wheels which appeared to be running backward. They also established standard speeds for both photography and projection, as it is necessary for a movie to be projected at the same speed it was taken, unless distortion, flicker, or errant effect is desired. Fast movie takes were important for stunts and particularly for news reels. But conventional theatrical projection had only the human eye and still studies to meet the demands. Theatrical slow-motion pictures are seldom shot faster than 164 frames per second.

The super-high-speed movie really got its start with the Los Angeles Olympics. Electrical Research Products of Western Electric coordinated with Eastman Kodak to produce a super-high-speed job including an accurate timing device right on the film. Then a couple of two-year-olds stepped into the picture. The two-year-olds were race horses. A man named Day took this camera out to the race tracks and began shooting race finishes. The work was particularly important in close finishes, where one horse might be in the air, and a whisker ahead of the horse on the ground, as they crossed the tape.

Industrial uses for the clock camera were soon found and the high-speed camera was on its way under most stimulating sponsorship—big business. Simultaneously, Bell & Howell and others were developing high-speed work for special purposes. The Massachusetts Institute of Technology, with an eye toward advanced scientific fields, was developing the J. W. Edgerton-MIT camera on different principles.

Some small background may be necessary. First, the human eye is something of a troublesome problem to science. Opticians are still trying to find out if it "sees" while in motion. When you switch your eyes, do they stay focused and "record" objects within range? Or do they "scan" and alter direction of

vision in a series of very rapid, synchronized stops and starts, with vision blank during intermediate moving periods? Or does one eye move a fraction, then stop and focus while the other eye moves a bit farther along?

We assume that there is a shutter mechanism connected with the human eye and we know that some human eyes are faster than others. But we have not found out for certain whether Brother Johnny watches that last slice of roast duck "constantly"—that is, with unbroken vision—or whether he sees, roughly, twenty separate frames of the duck per second. If he moves around the table with his vision glued on the duck for one second, does he see it from twenty positions, or more, or less? All we actually know is that if the duck is whisked away in a faster period than  $1/20$ th of a second, Johnny will have a hard time following its course, and may see only a blur or catch a frame of the duck at one point.

However, he is liable to catch the same picture if the duck is whisked away in  $1/50$ th of a second, depending upon his eyesight. But in this case his eye retains the impression for  $1/20$ th of a second. We know, roughly, how long the human eye retains an impression, but we have very little idea of how long it requires to "shoot" the scene. If you flip rapidly through a book of photographs you may "record" 20 photos per second, or a blur, or some very weird composites, depending upon your personal eyesight and your ability to mentally unscramble what your eye has seen. At least you will get a very strange impression of movement. But you will not be able to distinctly picture to yourself more than 20 scenes per second.

SUCH QUESTIONS are vitally important, for photography is based upon what little we know and conjecture of human sight. If the human eye "sees" constantly while in motion, or "sees" a

rapidly moving object constantly, then it has got the camera licked. Out of a "continuous vision," the retention mechanism of the eye would select about 20 stills and retain them long enough for the nervous system to react.

The camera cannot see constantly. A continuous running film with no breaking of light to cause frames will be a solid blur. But in so far as the super-high-speed camera can shoot up to 10,000 separate pictures per second, it has the human eye beat. The speed of projection is then slowed down to 1/500th and the human eye can study what the camera has seen.

The point is that the human eye may possibly see movement, but it records only in 1/20th second periods, so that for all comparative purposes it does not see actual movement, but sees about 20 stills per second, which gives the illusion of seeing movement. With the ultra-high-speed movie camera we approach actually witnessing movement.

It is all a bit queer to the layman because what he thinks he sees ordinarily is no longer there if the object is in motion. It is nearly 1/20th of a second away. The time is established by the fact that nature usually knows what it is up to. If the human eye has been made to retain an image for 1/20th of a second, then, broadly speaking, it requires about the same length of time for the nervous system to picture the retained image. If a fighter hit accurately at the moving chin of an opponent where he saw it, he might easily swing in air. His nervous reaction is to hit a little to one side. Which side he hits to is the result of fighting instinct and the acuteness of his perception of movement.

But don't try to explain this to a pugilistic friend if within walloping distance. He is liable to end up by proving very conclusively that he can hit a nose which he is looking at—your nose!

One of the first scientific uses of the high-speed camera was a study of nerve

reaction. An athlete was used as subject. A lighted cigarette was mashed on the back of his hand. The cigarette had already been removed, as shown in the slow-motion pictures, when the hand started to react. The time of nerve reaction was 1/18th of a second.

For some eye-nerve studies, the subject was a crack rifle shot. A flashlight was fired directly in front of his eyes. The flash was timed at 1/40th of a second. It required 1/15th second from the start of the flash to the start of the eye response. Note the second conclusion—the eye retained the image longer than the action itself required.

Super-speed movies would have shown that there was a time elapse between events, but, by themselves, would not have shown the exact time. It is here that the development called the time microscope by Western Electric becomes important. Simultaneously with shooting scenes, a second lens records a time clock on each frame of the film so that comparative studies, precise down to 1/1000th of a second, can be made. The term, time microscope, has nothing to do with enlargement of vision. It was coined to express the enlargement of the time factor.

The 2 present schools of super-high-speed-motion-picture work are progressing about evenly along divergent lines. Both face 3 common difficulties: light, film sensitivity, and film strength. With necessary lighting the square of the speed, the light problem grows increasingly difficult the higher the speed. So does film sensitivity. And above 2500 frames per second the swift-acceleration stress brings difficulties of film breakage.

Both schools are working with 16 mm. film for the reason that it gives 40 exposures per foot compared with 16 exposures per foot on the theatrical 35 mm. film. The weight of the film is a considerable factor in motor power, speed of acceleration and uptake, and space requirements. In the commercial West-

ern Electric job the motor can handle up to 200 feet of film efficiently—giving a maximum of 8000 exposures, slightly over 3 seconds' filming in high speed.

Both cameras are distinctly different from the conventional theatrical camera. The latter pulls its film through with a sprocket, stops and starts for each separate exposure. The necessary acceleration on complete stops for high-speed work would rip the film and motor to shreds. Both high-speed jobs operate with continuously running film.

THERE the mutual similarity ends. The famed J. W. Edgerton-MIT camera runs its film over a large drum. A commutator on the sprocket makes contact with mercury vapor lamps firing as fast as 1/100,000th of a second glows. Fast-acting vacuum tubes light the lamps. There is no shutter on the camera, exposure being made on the stroboscopic principle.

Theoretically, there is nothing to prevent the camera from taking 100,000 exposures per second. On some fortuitous occasions the speed has actually been carried up to 10,000. But at excessively high speeds even the present super-X film has a tendency to discharge static, causing film fog. Then, although the vapor lamps glow only 1/100,000th of a second, no circuit has been perfected which will fire that rapid in sequence. The use of spark lighting has been tried, successfully, but it is still a laboratory matter.

While the stroboscopic type camera has many advantages for excessively high speed and scientific work, the outfit is bunglesome to transport and its use circumscribed by light requirements and space conditions at the scene of shooting. For a time, at least, its use appears largely limited to operation under laboratory conditions.

Cameras of the Western Electric-Eastman type are compact, transportable and operateable by one man. The

camera uses ordinary daylight or any bank of lamps capable of eliminating shadow. Speeds up to 2500 frames per second are practicable. (A similar camera is now being developed by Eastman to achieve 4000 to 5000.) There is the additional advantage in that this camera can photograph any self-luminous object, such as electric welding. For the same purpose the stroboscopic camera would have to develop some high-speed "black" beam to break the light. The stroboscopic type, however, can shoot much longer continuous film. Color film can be used by both cameras and is particularly valuable for photographing chemical processes and flames and gases.

Technically, the trick of producing clear exposures on continuously running film was a major achievement. No "lens timing" imaginable is fast enough to alter the fact that while the camera is trying to take a single distinct still picture the film is running. From this standpoint, the stroboscopic principle had definite advantages. The commercial camera could not utilize a fast lens shutter which relied on mechanical timing and was subject to the errors and ills of mechanical movement.

The time microscope uses a continuously rotating optical flat between the lens and the film. It is synchronized to the film speed and the image is passed through an aperture so that it captures one image every half revolution. In its early days it caused some consternation because the tail end of the image went out of perspective as the film moved past. This is now corrected so that the image thrown by the lens passes through the flat and follows the motion of the film during the instant of exposure.

The super-speed cameras had one other drawback. A true constant speed is nearly impossible to attain, even where a separate series motor is used for the take-up reel. Practicable reel lengths are short. The first exposures



may be at the comparatively low rate of 5 or 6 frames per second, while those toward the end of the film may be faster than 3000, when the mechanism is set for 2500 fps. Motors to overcome the problems of rapid acceleration stress on film, and the variable of weight or motor would be too large for many uses.

The result of this was that where the time element between exposures was a vital factor, in its finer sense, there was no means of comparing 2 pictures on the same reel, except by rough estimate of the time space between 2 exposures. For this reason the time microscope was developed with synchronized clock timing on each exposure. First thoughts for the clock were that it could be operated by a synchronous motor using an electric-light circuit as a source of power. But while the total error in time never exceeded a few split seconds, the instantaneous rate jumped around like an atom missing an electron.

The solution of the problem was the electrically driven tuning fork generator producing alternating current (the camera motor also uses AC), the error of which frequency can be made less than one part in 30,000. The clock also corrected error factors such as variations of acceleration speeds, film slippage, etc. The perfection of the clock made the camera a quantitative instrument of use for accurate engineering and scientific analysis of high-speed movement. The missing factor, *time*, was supplied.

IT IS OBVIOUS how important the time element is to the correction of mechanical flaws, such as establishing the exact point of friction or static in a machine, or correcting a finely adjusted valve. For instance, a big expensive wrapping machine went on the rampage and was tearing cellophane wrappers. Super-speed photography would have shown how the wrapper was torn, but not precisely *when*. The time microscope

showed both and the error was corrected.

Prior to the accepted development of the clock, some physicists were of the opinion that theory already established a great many rules for timing which the clock merely verified. Given the distance of drop, weight and shape of object and resistance of a liquid, it was believed that the full picture of the drop and splash could be drawn. A test was made.

An ordinary marble was dropped into a bowl of milk. It sank, was covered by a cone. The surface of the milk went nearly quiescent. Suddenly a spout of milk shot up from the exact center of the cone. The time factor rather spoiled the accuracy of the theoretical picture. The clock in the corner of each exposure showed that it required  $1/20$ th of a second for the marble to hit the milk; between  $1/40$ th and  $1/30$ th of a second to be covered by the cone. The milk was almost quiescent, then it required an interminable  $1/6$ th of a second for the spout to rise. Theory gave different timing.

A synthetic stone, in certain respects superior to any nature offers for building needs, has long been developed. But it had a weak spot. Between 5 and 10 years of age disintegration set in. Disintegration is often made up of a long succession of very rapid minor changes. Where does the thought lead us? Right into atomic chemistry! Atomic chemistry is fairly well advanced in theory. If we can find the precise time factors between a series of events, we can often project the data beyond. If we can get photographs of a certain type of cracking, with the precise timing of the phenomena under certain known conditions, we can tell which of several factors is causing the cracking.

There are many very simple little human-interest studies being made with high-speed cameras at the moment. The petite humming bird gains more and more attention. Its wings have been

found to have 60 or 70 pulsations per second. Its wings and tail move, but it has the peculiar ability of maintaining a stationary place in space with the rest of its body and head stationary. Is this important? It is of vital importance to the progress of autogyro aerodynamics.

The seagull has the peculiar ability to go into what is almost a power dive, then come up at a timed instant in absolute suspension. Most other birds have to loop out of a dive. At the moment its dive terminates there is enough pressure and stress upon its wings to snap them asunder—theoretically. Yet they don't snap. The exact, timed explanation of how the bird maneuvers may mean a new type of commercial airplane.

An electronist was carrying on experiments with a very delicate, specially constructed tube. At a certain point in the experiments the tubes kept breaking. A quick study of ultra-slow-motion pictures, with the time factor disclosed, made possible a correction in manufacture. Had the time factor been thought a fraction different, an entirely different cause would have been concluded.

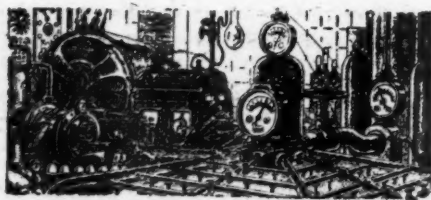
In the speed fields of 500 to 10,000 exposures per second lies the answer to many perplexing questions. Studies are under way in numerous fields of physics, electronics, mechanics and chemistry. There is particular interest in fast gas explosions, where the vagaries of certain gases are not fully understood. Such

detailed analysis as the high-speed motion-picture camera makes possible is vital along the road of 100-mile-per-gallon automobiles; steel of 1/5th weight and 10 times increased strength; combustibles giving super heat at lower cost; the development of synthetics.

Possibly its greatest immediate field is in correcting the tremendous mass of small errors which an industrial science has accumulated in its dynamic, rushing growth. Here is the chance to analyze, correct and make efficient and effective the machines, processes, chemicals, and knowledge we have not yet had time to order. And then, from the firm footing of an ordered science step into the super science of a not-distant future.

The important thing is that the mechanism for doing this is now ready—a super-fast eye of time. Scientists and engineers are actually witnessing the workings of the things they have created, and, in cases, learning how little they really knew of their own scientific offspring.

It will make a great difference, little things like actually seeing how a flame wavers with varying chemical elements infused. Even baseball is feeling the time camera. How long does it take the favorite pitcher to release the ball after his "throw" has reached its terminal point? Some very superior coaches are pretty worried right now about the public seeing some of those pictures. Fans might resent slow nerve reaction in some of their favorites.



# THIS AND THAT

Rumors seem to fly faster in the science-fiction field than they do in any other group of my experience. Certain people seem to be gifted with the ability to start stories moving on an endless chain of repetitions; and each time a story is repeated it grows.

So I'm going to try to state a few pertinent facts.

Astounding Stories enjoys the largest circulation of any science-fiction magazine. Its leadership has not been threatened at any time since it came under the Street & Smith banner.

The magazine is firmly and successfully established as a monthly. We have no intention of changing it either to a bimonthly or a semimonthly. We have no intention of publishing a quarterly. Although, through an error in the production department, some thousands of copies of the July issue were untrimmed—Astounding is not abandoning its trimmed edges.

The opening installment of Dr. E. E. Smith's "GALACTIC PATROL" in this issue is sufficient proof that Astounding will continue to maintain its leadership in science-fiction stories.

The enthusiastic response we have received from readers following the introduction of science articles as a regular monthly feature, has proved to my satisfaction that our audience is interested in the acquisition of scientific knowledge as well as in the entertainment value emanating from things scientific.

Science Discussions, as a department, is proving fruitful in its dissemination of the bases of opposing theories. The very fact that we read the opposed viewpoint is going to leave us all well able to discuss the controversial subjects with better than ordinary perspective.

These, then, are the facts as I see them from the editor's chair. Never has the future of science-fiction looked brighter than it does to-day.

We have come a long way from that day four years ago when we started to rebuild the flagging interest in the field. The new Astounding completes its fourth successful year with this issue and we are proud of the trail of literary gems which dot that four-year path.

Next month we start our fifth year, with every reason to believe it will be the greatest of all. Help me to make it so by passing your copy of this issue to a friend to read, will you? Thank you.

The Editor.



*They glided down toward the second  
jewel—a growing bubble of shim-  
mering white, lying on something  
like black velvet.*

by  
**JACK  
WILLIAMSON**

*Part Two*



# Released Entropy

*Concluding a novel of scientific power*

## UP TO NOW:

For two full centuries of grim exile on Pyralonne, a frigid, sunless "run-away" planet two hundred thousand light years from the galaxy, the Gyroc-Goneen expedition labored to make ready for the great experiment.

The leader was Seru Gyroc, acclaimed the greatest scientist of all interstellar mankind, whose supreme ambition was to master the Omega Effect, based on the tensors of his own discovery, and so control the direction of entropy increase.

With him was Ron Goneen, tall, bronzed captain general of the Galactic Patrol, the scarred veteran commander of the First Andromeda Expedition. It was in that far star cloud that he had taken from the temple of the warrior crystals, the wondrous Jewel of Dawn.

Captain Goneen had warned the Galactic Council of the peril in any tampering with the force of creation. When the protest failed, however, he promptly joined the expedition with his great kappa-field space cruiser, the "Silver Bird."

Having fallen in love with Lethara—Seru's beautiful daughter, born on Pyralonne—the space captain felt his old fear return. His last effort to stop the experiment failed, however—and his worst apprehension was realized.

For the other life, born under the strange conditions of the Omega Effect, forced Seru to release the entropy-reversing radiation upon all the universe. The result was mad chaos, horror and doom. Time was annihilated. Spinning incredibly in reverse, the galaxies ahrank, grew swiftly dark, plunged to-

gether in a suddenly contracting space. "The universe is winding up again," Seru explains. "All matter will be condensed again into a single superatom."

Seru Gyroc is strangely changed by the force he set free; he is suddenly old!

Venturing out of the insulated laboratory tower, amid the cold, black phantoms of the other life, Ron Goneen rescues Lethara from the wreck of the "Silver Bird." But Seru tells him that only the three of them, out of all humanity, remain alive.

And they seem doomed to perish soon.

"I have murdered mankind!" quavers the stricken scientist. "I have murdered the universe!"

## IX.

**R**ON GONEEN slept for a long time, but not without dreams. He thought that the armored tower, containing himself, Seru Gyroc and Lethara, was somehow cast loose from desolate Pyralonne. He thought that it was spinning end over end, forever, through an illimitable, starless chasm of frigid darkness. He thought that vampire hordes followed it—spinning, shapeless shadows of black flame, that sought to enter, to suck away their warmth, their lives, their bodies.

When at last he awoke—lying still dressed on the couch where he had flung himself when he came down from the laboratory, exhausted with fatigue and cold and the horror of universal doom—his body still had a dull, leaden numbness. He felt a lingering, vague nausea, as if that vertiginous dream had been half reality.

"Ron, dear, you are—are well?"

He sat up with a start of eager joy, for it was Lethara's soft voice. She was standing beside his couch, with a tray of steaming food.

"Oh, my darling——"

The eager greeting stopped in his throat. For his clearing eyes had seen her face. For a shocked, bewildered moment she seemed a terrible stranger. Like her father, the girl had been—changed!

She was thinner. Her oval face was haggard, and it had an ominous bluish cast. Her lips were pale and dry. Her violet eyes were darker than they had been, and hollow. They were wide pools of horror nameless and unutterable. And her wavy golden hair had turned, like her father's, completely white.

Ron Goneen lightly touched her hand, tried to conceal the shock on his face. He tried to make his deep voice gay. "How is the most beautiful woman?"

She shook her white head, with no answering smile. "Father has told me I am the only woman," she said. "Therefore, I must try to live—though I can feel the cold of death still in me.

"But do not say that I am beautiful. I know that I am changed. And I saw the dread in your eyes——"

"Nonsense, my darling!" He took the tray out of her quavering hands, set it down, and gathered her in his arms. He kissed her, and her lips were very cold. "I know you had a terrible experience outside," he told her softly. "But you will get over it. You must! It means so much——"

"I know," her dry voice said dully. "And I'll try, because it means so much for the race to go on——"

He held her cold, trembling body closer to him. "Because it means so much for you to go on, my darling! You must get well, and laugh again. You must forget——"

"I can never forget," she said solemnly. "And I feel that something is

dead in me—forever!" She clung to him for a moment, with a desperate, shuddering strength, and then pushed out of his arms. "You must eat, and then my father wants you in the laboratory." She pushed the tray toward him.

"It was good of you to bring it," he said. "But you must take care of yourself. Have you eaten?"

"I couldn't," she said. "I wasn't hungry."

He picked her up in his great arms, carried her, laughingly protesting to her own bed, and made her lie down while he fixed her a hot drink. When she had sipped a part of it, he left her and climbed back to the room beneath the dome.

THE THIN, shattered frame of Seru Gyroc was still pacing its endless, tortured circuit about the wrecked apparatus. His whitened hair was wildly tangled, his hollow eyes red for want of rest.

"There's no way?" Ron Goneen greeted him heavily. "No possible way?" His mighty, bronzed body stiffened suddenly; his scarred fists clenched. "We must find a way, Seru—for Lethara's sake!"

The bleached head nodded. "I know. For the sake of mankind——"

"And for her own sake." The space captain's deep voice was low and solemn. "She is very ill, Seru. Those things of black fire came too near her. It's too dark for her here—too cold! She needs the warm air and bright sunlight of a young, living world.

"This universe is dead, Seru. Life—our kind of life—has become an anomaly since entropy is reversed. And she feels the death. Perhaps it is the other life creeping into her!"

"We must escape—and very soon!"

"If we could escape!" quavered the hollow voice of the stricken scientist. "But there is nowhere to go. The

Omega wave has spread ruin to the limits of our universe. There may be others: my mathematics indicates that probability. But even if other closed space-time continua exists, we have no gate, no key——" His thin shoulders shrugged hopelessly; he resumed the aimless walking.

Ron Goneen stood for a little time silent, staring at the scientist, his red-bearded face grimly desperate. His great hand reached slowly, absently, into his tunic, and brought out a half-inch bubble of silvery light.

"I wonder——" his deep voice grated huskily. "You say there could be—— another universe?"

He tossed the shimmering droplet on his palm, caught it and tossed it again. His narrowed eyes stared down at it. Seru Gyroc stalked wearily by him, making no answer.

"I call this the Jewel of Dawn," his deep voice rumbled. "It was the most sacred object of the Andromedans. They had told us something of it, before the massacre——"

"Eh?" Seru Gyroc had halted, suddenly listening.

"It was the heart of their barbaric religion," said Ron Goneen. "They held that it was itself another universe—— or at least the door to one. They believed that one day, when they had reached a certain level of perfection, all their race would be allowed to migrate into it.

"I shouldn't have taken it," he added, "but for their treacherous murder of half my men, and because I thought that carrying it would give us some protection."

"What is it? Not just a pearl?"

"No," said Ron Goneen. "It is harder, more perfectly round; and it emanates a soft, steady light. I've never seen anything like it on any planet. I've never attempted to analyze it, because I didn't want to destroy it."

The dark, hollow eyes of Seru Gyroc

were suddenly flaming. "Hard?" he whispered eagerly. "Perfect? Constant luminescence without excitation?" Trembling, his thin hand grasped for it. "It's just possible—— The theory of interpenetrating space time manifolds——"

He dropped the jewel, fell on his knees to scramble for it furiously. Ron Goneen caught up its shimmer as it rolled away, returned it to him.

"——just possible," he breathed, "that the Andromedans were right!"

## X.

AS THE OLD MAN worked with trembling hands and feverish eyes at his tests upon the jewel, Ron Goneen again opened one of the shuttered ports to look from the laboratory tower.

All was darkness now. The last bluish ghosts of the contracting nebulae had vanished. The bleak, frigid landscape of Pyralonne, if still beneath them, had lost its eerie radiance. The black phantoms ruled supreme.

He shuddered, slammed the shutter. His senses reeled from the shock of an alien other being, without. Black tentacles of freezing flame, he knew, had sought to reach him through the port.

Numb again, trembling to a sense of overwhelming dread, he went back down the stair to where he had left Lethara sleeping. She lay very still. Her thin face, framed in her silver-white hair, looked terribly bleak and cold.

She shuddered in her sleep, as he watched. The leaden shadow of horror fell heavily on her face. Her pale lips parted, and out of them came a dry, gasping sob of utter fear.

"My poor, poor darling," whispered Ron Goneen.

He went softly to her, smoothed her cold forehead with his palm, and took her cold, blue hand in his. The tiny, frightened ghost of a smile came then to her sleeping lips, and her hand clung to his fingers.

He left her sleeping more easily, and returned anxiously to the laboratory, where Seru Gyroc was still working feverishly over the stone from Andromeda.

"Well?" he gasped. "What have you found?"

"Very strange!" the old scientist quavered. "Perdurable. No wonder the Andromedans worshiped it! Its hardness seems perfect. Nothing will scratch it. X ray and electron diffraction patterns reveal no crystalline molecular structure—no molecules at all. Its surface is a perfect mirror; no radiation will penetrate it. It is not affected by the cold of liquid hydrogen or the heat of the atomic furnace. It is not a conductor of electricity, nor permeable by a magnetic field."

"Then," demanded Ron Goneen, "what is it?"

"There is one possible explanation," the old man said: "that the Andromedans were right! The negative result of all my experiments can mean only that it is walled off from our space—that it exists in its own closed continuum."

"Another space?" Ron Goneen gasped eagerly. "Then is it possible—by any means at all—for us to enter it? To escape?"

The old man shook his head.

"Hardly. The existence of a universe of such dimensions is mathematically conceivable. Our own will doubtless contract to such a size, or smaller, since the reversal of entropy. If," he added, "one may speak of the size of one universe in the scale of another!"

Again he shook his head.

"But each galaxy in such a universe would be no larger than one of the atoms of our bodies. How, then, could we enter it? Still," he suddenly interrupted himself, "there is the Kardishon Effect! Contraction of size is theoreti-

cally possible, through electronic acceleration and energy compensation along the time axis."

WEARILY, he shrugged.

"But actually, with our limited time—for the tower will not protect us much longer, before the insulation fails—or before we are crushed by the contraction of space outside—"

"You are the galaxy's best scientist," Ron Goneen urged him. "You are working to save mankind! You must try—"

"Yes," the old man said soberly. "We must try to save the seed of mankind from the horror that I have wrought." He gulped. "Yes, we must try— But even if we could master the Kardishon Effect," he objected, "we should require a complete ship, able to navigate empty space."

"We have one of the *Silver Bird's* life tubes here in the tower," Ron Goneen reminded him. "It is supplied and equipped to voyage two hundred thousand light years. If we could install size-changing apparatus aboard it—"

Seru's red, hollow eyes were staring at him, with a new light in them. "There is a possibility—" he breathed huskily. "The barest possibility! The apparatus would consist of the Kardishon oscillator, transformers and field coils. The installation would be difficult."

"I'm a fair technician," said Ron Goneen. "Let's get to work!"

"I can design the field coils," Seru yielded, "and you can be installing them. But it will all be useless," he warned, "unless I can solve the problem that floored Kardishon, in the oscillator. For all the matter that he tried to contract began to disintegrate, because the shrinking atoms became unstable." He shook his head. "I don't know—"

"We'll try, anyhow!" said Ron Goneen.



"Until we die."

The haggard scientist turned to a workbench, and began to sketch plans for the coils that were to take form under the unsuspected expertness of Ron Goneen's big hands.

The life tube, sealed into a rectangular chamber in the base of the tower, was a small craft, not a hundred feet in length. Lethara—when at last she awoke and came down to where Ron was desperately at work wiring up the new coils—named it the *Life of Man*.

She seemed ill and depressed. Ron Goneen paused to fix food, which she could not eat, and made her lie down again, aboard—for she was unwilling to leave him to go back above.

The two men labored on almost without pause for food or rest. The big space captain knew that time was becoming very short. For into the tower was seeping a penetrating cold, a chill of half-tangible horror, that defied all their lights and heaters.

And a time came when Ron's task was almost done. He was inspecting the last connections, and Seru was still up in the laboratory, at work on the vital oscillator, when he heard Lethara scream.

He ran back to her little cabin, amidst ships, and found her sitting bolt upright in her bunk.

Her eyes were wide black pools of horror, her face ashen. Her dry voice was sobbing: "They've broken in! The others—the things of black fire! I can feel them. They have come for us. They want our warmth, our lives, our bodies. We must go, Ron! Go—"

He was trying to soothe her.

"We can't go quite yet," he told her. "The Kardishon apparatus isn't finished, or tested—"

"Oh-h-h-h!" her thin, agonized scream cut in. "They've got my father. Ron—"

Her voice rose on his name to a shud-

dering wail of utter horror. She stiffened. Her skin queerly blue, she fell rigidly back on the couch.

Trembling to a sick chill, Ron Goneen knew that the other life, indeed, had entered the tower. And to his ears came the stricken shriek of Seru Gyroc—trapped outside the vessel!

## XI.

RON GONEEN left the girl and ran to the air lock of the little vessel. A wall of bitter cold met him. The air in the long chamber glittered with crystals of frost. White rime was forming on the walls.

And his spine tingled to a chill more deadly than cold—to the instinctive, overwhelming dread of an alien presence: the other life of the reversed universe!

Numbed and sickened, still he didn't hesitate. Seru, he knew, had been on the floor above, finishing the precious oscillator. Catching a deep breath, he plunged into that sea of frozen menace, ran up the steps toward the dome.

The invader, he knew suddenly, was in the laboratory. For a terrible, shrinking dread increased in him, until it took gritted teeth and all his will to mount each successive step.

A strange darkness filled the room beneath the dome, when at last he fought his way in. The lamps still shone, but their radiance had contracted to little feeble moons, outlined with ghostly blue.

Stumbling forward through that thick, frigid barrier of dark, Ron Goneen found the scientist sprawled on the floor. His stiffened body was shrouded in a dreadful aura of shimmering blue. Clutched in his lifeless fingers was the tiny, bright tube of the vital oscillator.

Ron Goneen picked up the rigid form. Before he could move with it, however, something came toward him out of that dense darkness. It was dark also, shapeless. It was nothing that he could see;

it made no sound—yet he was horribly aware of it.

Numb and stiff, he reeled back from it. Carrying Seru, he staggered back down the stair and into the silvered hull of the *Life of Man*. Gasping with relief, he closed the valves.

The scientist was still living, although pinched and blue with cold. His face was a mask of strain and horror, his pulse very slow and weak. Ron Goneen covered him up in a bunk, then hastened to the generator room to install the oscillator.

As he finished the task, some little sound made him look up, and he voiced an involuntary cry of startled apprehension. For Seru Gyroc stood swaying before him, a very specter of dread. His white hair was loose and wild, his shrunken body bloodless and violently trembling. His dark eyes were dilated and glazed with uttermost dread.

"We must hasten, Ron," the thin voice rasped from his fear-dried throat. "There is no time for any test. They are seeking now to enter the ship. We must try it, to escape—or perish!"

RON GONEEN led the way to the tiny bridge. It was bitterly cold, even within the vessel. And the strange, thick darkness had come into the chamber outside. The lamps were gone. He could just distinguish the dim, silvery sphere of the Jewel of Dawn, which he had laid ready on the bench across the end of the chamber.

He remembered its shimmering beauty, which he had rolled so often in his palm. Could it be actually a minute universe, complete, a haven for a new mankind? That seemed incredible, but still—

"Start it!" gasped Seru. "Now—or they might take the jewel! Now! To freedom—or death!"

The space captain touched a key. The atomic generators responded with a soft humming; the meters indicated that half

their output was flowing into the Kardishon oscillator.

But he felt nothing, no change of size. He shook his red, shaggy head at Seru Gyroc. "Nothing," he whispered. "I guess we've failed——"

"No. There's no disintegration." Then the other's cracked voice was suddenly sharp with excitement. "Look! The walls——"

Ron Goneen peered through the observation ports. The walls of the sealed chamber had become visible again, shining very palely with a familiar, eerie blueness. They seemed very far away—still receding.

"The room seems larger!" he cried. "No—of course, it is we who are smaller!"

"One way of putting it is as true as the other," said Seru, "remembering the relativity of size."

"But it worked—it really worked!" the space captain rumbled eagerly. "We didn't disintegrate! We're safe!"

"We're growing smaller," admitted the little scientist. "But we aren't saved yet! First, we don't know that the Kardishon Effect can be carried off infinitely. Second, we don't know that we can actually enter the smaller universe. We may be lost outside it! Third, there is no assurance that its planets—if it is a universe and has planets—will satisfy the conditions of human life."

Steadily, as he spoke, the bluish walls receded. Their hue changed to a dull, sinister red, and then was lost in darkness—through a relative change in the wave length of light.

Only the gem from Andromeda remained visible: an expanding bubble, always shining with the same silvery white, floating in a chasm of darkness.

"Better keep near it," warned Seru, "or we'll be lost in size. Our old inches are growing into light years!"

The big space captain started the kappa-field drive. The diminishing ves-

sel lifted from the now invisible floor—lifted upon the strange, interminable voyage from universe to universe. The silvery sphere hung in black and utter emptiness, always growing. Steadily, he drove the *Life of Man* toward its surface. And steadily grew the intervening space, so that the voyage began to seem like a fantastic flight to nowhere.

MANY HOURS, Ron Goneen was thinking, had already passed on that uncanny flight—when it came to him that time, as well as space and size, had its meaning strangely twisted on such a voyage as this.

He left the controls with Seru, after the old man had rested, and went to look after Lethara. He found her awake again, lying quietly in her bunk. Some of the horror had gone out of her eyes, but she seemed very pale and tired.

He tried to put a little cheer in her.

"We're voyaging to another world, my darling!" he whispered. "When you see the light of a sun, and smell the clean air of some warm, blue sea, and watch green cover the hills of a new planet in spring—just wait and see how good you'll feel!"

Her white head shook weakly on the pillow. "Ron, my dear," she breathed, "you don't understand. I tried to live—but I'm too old. Somehow the other life made me old. I'm older than any human being ever was! And I desire nothing but rest. Kiss me, and let me sleep—"

He kissed her lips, and they seemed icy cold again.

The haggard, gaunt form of Seru Gyroc, when he returned to the bridge, stood rigid before the instruments.

"We are near the crucial point," he said. "We must break through the shell while we are yet relatively large—while there is power enough. The kappa lines interact with the geodesics of the other universe. We must make the field

strong enough to merge them. Speed up the generators!"

Still the *Life of Man* plunged through uttermost darkness toward the silvery bubble—which now had become infinitely huge, so that its surface was like an illimitable flat mirror.

Ron Goneen increased the power of the generators, until their soft humming became an ear-piercing whine. The vessel leaped forward, toward that mirror film. And it bent before them, yielding like an elastic sheet.

"More power!" cried Seru. "And hold fast! There must be a shift of dimensional axes. We see now only a three-dimensional section of the other universe. The merging world lines must rotate our fourth axis into it!"

Grimly, Ron Goneen pushed the control lever forward all the way. The tiny ship shuddered and rang to the vibration. His feet stung on the deck. He felt a sudden apprehension for Lethara and—

Then that yielding elastic film seemed to snap toward him—and it was gone! At the same instant the ship lurched queerly, in some direction that was neither to right nor left, up nor down.

Giddy from that unexpected, oddly disquieting lurch, he clung to a hand rail, peering bewilderedly about for that shining barrier. It was not behind them. It was nowhere.

And the vessel was plunging, with generators screaming at full power, through a featureless void of utter darkness. He groped hastily for the control levers, shut them down to cruising speed.

"So we're through?" he gasped incredulously. "We're in the other universe? And nothing to do but find a nice friendly galactic system, and a good solid planet of the right chemical order?"

"I must go tell Lethara—"

THE space captain's eager voice stopped suddenly, with a little gasp of

apprehension. For Seru Gyroc had made no reply. His eyes were fitted to the twin lenses of a compact binocular telescope.

Ron Goneen bent to gaze into Seru's haggard face, saw it etched with new despair. Fearfully, Lon demanded: "What is it, Seru?"

Still the scientist made no response, except for a weary, hopeless little jerk of his white head.

Anxiously, Ron Goneen peered through another port. "Why is it so dark?" his husky whisper rasped. "The thermometers show almost absolute zero. Why? Why are there no stars, no galaxies—anywhere?"

His big hand seized Seru Gyroc's thin shoulder, spun him away from the telescope. "Tell me!" he demanded. "Is it because we are yet too large to see!"

"No," came the dry, weary breath. "We are small enough. But we have failed." His white head shook very slowly. "We should have expected it, from the relativity of time. For time obviously must have flowed much faster in this tiny universe—so long as it had any time!"

The space captain's big body sagged wearily back against the bulkhead. "Time——" his dry lips said soundlessly. "Too late——"

"Too late," quavered Seru, "by a billion, billion years. This universe has reached the fate from which the Omega Effect experiment was designed to save our own. It has run down. It has reached thermodynamic equilibrium, a state of maximum entropy.

"Its stars have all been disintegrated into energy. And the energy has wasted itself, in ever-longer, ever-weaker waves, through an infinitely expanding space. Its smallness, after all, was only in our own perspective."

He sighed again, hopelessly.

"No, this universe is what it looks—frozen, dark, dead. There is no longer

any change, nor will there ever be, unless the conditions of energy probability happen to be reversed. Even time, determined by the arrow of entropy, has ceased to flow."

Ron Goneen's blue eyes, dull and bloodshot, stared wearily out into empty, boundless darkness.

"So we have failed," he whispered. "Failed Lethara——"

"That is so." The old scientist nodded. "We have come from one extreme to the other. We can drive the ship onward until our fuel is gone—until we perish of old age—and never meet anything but darkness and cold and changeless death."

Beside him, then, Ron Goneen went suddenly tense. "But look!" he gasped. "I saw—— I saw——" He leaped to the oculars of the powerful little telescope.

## XII.

BREATHLESSLY trembling, too fearful to let himself hope, the big space captain stood with his eyes fastened to the lenses. Using the full aperture of the instrument, he searched the void ahead. For a long time he saw only cold, black emptiness.

Then it came again: a gleam of purple light! It was infinitely tiny, infinitely remote, infinitely brief—like the flash of a single, bombarded atom, he thought, in the spinthariscopes.

Tugging vainly at his mighty arm, Seru Gyroc was demanding, "What is it? What do you see?"

"Wait!" Ron Goneen was still peering intently. "It seemed so faint. I can't be sure!"

Another cruel eternity of darkness—and then it winked again!

"It is a light!" he cried eagerly. "A tiny, flashing light!"

Seru Gyroc ran startled fingers through his strangely whitened hair. "That is very singular!" he whispered. "A light in this universe that seemed so



dead! What could have kept alive, against the current of entropy, so long?"

"There it is again!" called Ron Goneen from the telescope. "A purple spark that winks like a signal beacon!" He moved suddenly toward the controls. "I'm going to set the ship toward it. We'll find out what it is."

"Caution!" The old man's trembling fingers closed on his big shoulder.

"No natural phenomenon could have survived to cause the intermittent emanation of light in a universe so old as this. That flashing represents intelligence—intelligence that has endured for aeons beyond conception!" His cracked voice was hoarse with awe.

"To have survived at all, when all else is dead, it must be supremely great. And it must have survived by defending itself. It may destroy us!"

The space captain shook his shaggy, reddish head. "No risk is too great now. For we have nothing to lose—no other hope. And there is everything to gain! A haven where Lethara can recover, a home for the race to come—" His big fingers dropped to the dials.

"If that intelligence is so great, perhaps it is great enough to share its knowledge. I believe that the signal was meant for a welcome and a guide."

"Or a trap," said Seru. "But go ahead. As you say, there is nothing else."

Ron Goneen lifted and swung the prow until that flashing atom of purple fire was dead ahead. When they were driving toward it, he left Seru at the controls and went back to the galley to prepare a tray for Lethara.

She was sleeping when he entered her cabin. His light step roused her, however, and she called to him before he could withdraw.

"Ron!" Her voice was feeble, yet deep with an indwelling dread. "Ron—please come and hold my hand. I had such a fearful dream!"

He set the tray down beside her.

"Here, my darling. Drink this. It will make you warm. And forget your dream!"

"But I can't forget it!" Huge and dark with abiding terror, her violet eyes fixed on his face. "It was too real to forget. It was more real than you are, standing here beside me."

Her thin body shuddered on the couch; the dilated eyes stared away, as if at some ghastly thing beyond the walls.

"Hold my hand, Ron!" she whispered. "I don't want to leave you. Hold it tight!"

Her haggard face smiled a little, at the pressure of his fingers. Her great eyes stared up into his face, suddenly serene and calm, with the enigmatic simplicity of a child's.

"I thought in the dream that I was dead," she said. "And the *Life of Man* came down out of dark space, upon some cold, dead planet. You and my father dug a grave in its frozen rocks, laid me in it, and filled the grave. You took the name plaque from the ship and left it at the end of the mound, under that starless sky. And you went away. And I was dead and alone in that world of death, forever—"

Her husky whisper died away. Her thin, cold fingers, which had tightened in a grip almost convulsive, slowly relaxed. Her great, dark eyes closed, and her pale body lay motionless.

Ron Goneen leaned over her, frightened. "Lethara?" he breathed. "My darling—"

Her eyes opened, then. She smiled at him wanly. He sat beside her, holding her cool fingers in a grasp almost fearful, until she had gone quietly to sleep again.

"RON!" the thin voice of Seru Gyroc quavered through the speaker system. "You had better come back to the bridge."

He slipped away from the girl—still

smiling faintly in her sleep—and hurried forward, demanding. "We are near?"

"The photometers show that the brightness of the flashes has increased four hundred times," the old scientist reported. "Which means, by the inverse square law, that we have come nineteen twentieths of the distance."

Ron Goneen was peering with narrowed blue eyes through a port, when the strange beacon—if it were a beacon—ceased its blinking and became a steady, purple point.

"See it!" whispered Seru. "That shows intelligence—aware of our approach!"

The big space captain towered alert at the controls. The solitary star became swiftly bright, and he decreased their speed accordingly. Still it was but a tiny, burning atom, alone in a gulf of empty blackness.

"We are near," Seru announced from the photometer. "A few miles more and—"

Eyes now against the oculars of the telescope, Ron Goneen watched the beckoning point. Slowly, it expanded to a tiny, reddish-purple moon. Dimly, at last, he could see its light cast on other objects.

"A great black sphere!" he rumbled. "Like a tiny, armored planet— The beacon is on a metal tower!"

"Armored!" Seru caught up the word. "Yes, it must be armored—against the loss of heat! For available energy is very precious here—even the stored energy of matter itself! Do you see any entrance?"

The *Life of Man* still slipped toward the light. Ron Goneen studied that black, armored ball. Several miles in diameter, it was yet tiny, he thought, to be the sole citadel of life in all a universe.

"No—yes!" His voice was suddenly tense and eager. "A slit is opening at the base of the tower—a great valve! A pale light is shining through."

"Some intelligence is opening it for us!" cried Seru. His hollow, bloodshot eyes darted sharply at the space captain. "It may be a trap!" he said. "Remember: the very matter of the ship and even of our bodies is precious, in this universe! Worth any crime—"

"I remember," said Ron Goneen, quietly. "But we shall enter. There is nothing else—"

Pale-white light, dimly reflected from the walls of the passage, showed the sphere to be of metal, not in reality black, but polished to a brilliant, silvery luster.

Now fully open, the mighty valve revealed a cylindrical well nearly a hundred feet in diameter. Without hesitation, Ron Goneen nosed the *Life of Man* gently into it.

"Strange to think," he said suddenly, "that all this is happening inside a half-inch jewel that I used to carry in my pocket!"

"But is it?" said Seru. "Remember our rotation of axes, and the relativity of size—" His cracked voice broke off, to gasp, suddenly, sharp with alarm, "But look! In the periscope—behind us!"

Ron peered into the tube, saw that the disk of blackness behind them was swiftly vanishing. The two halves of the great valve swung together as he watched, to form a solid wall of silvered metal.

"Trapped!" gasped Seru.

Ron Goneen's rugged, red-bearded face remained impassive. His steady fingers guided the little ship onward through the tube, toward another massive valve that closed the way ahead. Calmly, his deep voice rumbled, "We shall see."

### XIII.

AS THE big space captain's tanned fingers brought the *Life of Man* to a stop, a line suddenly cleft the metal wall ahead. The two halves slid ponder-

ously black, to reveal another section of the silvered passage.

Again he sent the little vessel forward, until they were once more stopped by a third barrier. The substance of it was unfamiliar, dead-black, lusterless.

As they waited before it, Seru said, "Whatever intelligence may dwell here is well shielded, indeed, against the loss of energy. Otherwise it must have perished a billion years ago."

The black wall also divided, in its turn, and they glided through into the last section of the tube. In view beyond its mouth lay an extraordinary space: the hollow interior of the armored globe.

Fully a mile in diameter, as Ron Goneen estimated, it was crowded with enormous, enigmatic machines, nearly all of silver-white metal that was polished to mirrorlike perfection.

"The high polish conserves light and heat," commented Seru. "You perceive that the actual illumination is very feeble. Energy is precious here—so precious that I fear for our own!"

Conscious of some strange depression, Ron Goneen struggled to analyze it, as he sent the vessel gently ahead toward the circular opening of the passage. It came to him suddenly.

Turning to Seru with a little shudder, he said, "This place is queer—dead! There is no sound. There's no whir or throb of energy. Those big machines don't move; they haven't turned for a million years!"

But the old man shook his haggard white head. "No," he quavered, "the flashing of the beacon and the opening of the doors is evidence enough of life. There is simply no energy to waste on friction and vibration. Eh——"

He stopped with a gasp, and Ron Goneen reached abruptly for the controls. For the gently gliding craft had come abruptly to a halt.

"We've struck something!" Puzzled, Ron Goneen shook his red head. "Some invisible barrier across the open-

ing——" His deep voice went suddenly tense. "But, look! There's something moving—coming toward us!"

Drifting across the pale silver intricacies of the giant machine, across the mazes of supporting girders, immense sealed rotors, and snakelike enigmas of armored cables, came the floating object. Anxiously, Ron Goneen turned the telescope upon it.

"It's almost a sphere," he reported excitedly. "It's greenish, and patterned with strange convolutions. It's almost like—like a great brain! It is flying toward us through the air—if there is air——"

The approaching object passed through the unseen wall that had halted them, entered the passage.

"It has stopped outside the air lock!" Seru's voice, from the periscope, was shrill with anxious emotion. "Shall we go out to meet it? The risk——"

"It took a risk of its own, letting us in," said Ron Goneen. "Come!"

HE LOCKED the controls, ran back along the corridor toward the valves. Pausing a moment outside Lethara's cabin, he saw that she still slept quietly, the faintest ghost of a smile on her lips.

"I'll take my positron gun!" panted Seru. "In case it has planned to attack——"

"No," rumbled the space captain. "Leave the weapon."

In feverish, trembling haste, they helped each other into two of the bulky suits hooked to the wall, clamped on egg-shaped, transparent helmets. Ron's gloved hands reached for the valve wheel.

Seru caught at his arm, with a warning whisper, "Consider——"

"I have considered," said Ron Goneen. "We are helpless. Lethara is asleep—unwarned. But there is no other way."

His own great hands trembled in the insulated gloves, as they gripped the

wheel. But the heavy outer valve slipped aside, and they stumbled fearfully out, toward the ridged, green mass of the thing waiting.

The little vessel had drifted against the silvered wall of the great passage. Almost weightless, here out of the ship's gravity field, they settled slowly to the shining floor. Their weary eyes stared apprehensively through the helmets.

The corrugated greenish mass—it was some three feet in diameter—approached them a little, hung motionless before them. Seru's bulging suit waddled back anxiously. Ron Goneen did not retreat, but his mighty body was rigid, beaded with sudden sweat. Unconsciously, he held his breath, and every muscle instinctively tensed for some effort of defense.

At last, however, when nothing happened, he turned to the old scientist with a little strained smile.

"See?" His awed voice spoke huskily into the little microphone before his lips. "It means no harm, Seru. It must have come to establish communication."

"Communication," quavered Seru's voice from the phones of the little ultra-wave radio set. "But tell me how! The alien heir of an alien universe! We can't just speak to it. Even if there were air enough to carry sound, it has no ears, no vocal organs. We don't even know how it senses us. It has no eyes that I can see. *Ugh!*

His voice became a gasping cry. His gloved fingers clutched convulsively at Ron's bulging arm.

"Look at it!" his broken voice sobbed. "I warned you! I wanted to bring a weapon. Watch it—*change!*"

Ron Goneen stared silently through his helmet, open-mouthed, staggered.

For that rugged green mass had suddenly lost distinctness. Its surface dissolved into a greenish haze. And the cloud of haze narrowed, elongated, swiftly flowing into another shape. It

became an upright pillar, nine feet tall. The pillar bifurcated into two supports, which touched the silvered floor. Twin appendages flowed out from its upper part.

THEN, suddenly, the haziness vanished, and Ron Goneen saw that this singular being had taken the shape of a man.

It was a gigantic form, standing nine feet tall. It was unclothed, and the greenish color of it resembled the patina of some age-tarnished metal. It was like some splendid, colossal statue, representing superhuman strength and manly beauty. Then it moved, and Ron Goneen gasped.

"Ron!" came the choked, incredulously protesting cry of Seru Gyroc. "That is *you!*"

The giant smiled, and Ron Goneen staggered backward. For the smile, save for some disturbing hint of immemorial despair, was his own!

That supernal, majestic form—save that it was naked, greenish, and some nine feet tall—was a reflection of himself!

The two men stepped back in the clumsy suits, breathless, speechless. That splendid green figure advanced one step toward them across the curved, bright floor. Its arm thrust out in an odd, arresting gesture.

And a strange voice, supernally deep, reverberated from the headphones in the two helmets, speaking their names: "Ron—Seru—"

The space captain's rugged, red-bearded face was grim with amazement. His narrowed eyes stared. He swallowed twice, and his husky whisper spoke into the microphone, "You—how do you know us?"

The green giant still smiled disarmingly. "I know words," that deep voice boomed promptly. "Speak words! I know words you speak."

Seru shuffled forward suddenly,





*That supernal, majestic form—save that it was naked, greenish and some nine feet tall—was a reflection of himself!*

AST—10

nearly helpless by reason of the slight gravitation, and picked at the sleeve of Ron's suit. His dry voice whispered from the phones, "I think I see it! He can understand what we say! He must somehow pick up the radio waves, and—somehow—perceive the images in our minds. That's it—it must be!"

"That's it," echoed the deep voice, startlingly. "I perceive the waves of your minds." The great green arm lifted commandingly. "Speak! I pick up words."

"Talk to him, Ron," whispered the scientist, urgently. "Tell him how we got here."

"Talk," parroted the amazingly deep reverberation. "Tell me!"

Ron Goneen gulped and wet his lips. "We are wandering fugitives from another universe, infinitely larger than this one," he began. "Because we have destroyed our own, in an experiment with entropy—"

The tanned space captain paused and swallowed again, staring through the helmet at his gigantic green simulacrum. "Do you understand that?" he demanded incredulously. "Do you know what entropy is?"

The shaggy, green-bearded head nodded solemnly. "I understand your words," the deep voice assured him. "Speak!"

Ron Goneen blinked and continued his narrative. The green giant listened intently, nodding from time to time in Ron's own characteristic manner.

A pleading earnestness came into the explorer's voice, as he, at last, concluded, "There is another with us—a girl. She is very ill. We seek a young, friendly planet, with warm sun and invigorating air—which will make her want to live again!"

He leaned forward urgently in the bulky suit, fear forgotten. "We have seen no stars in this universe—no worlds save this place of yours. Tell me—is

there a planet left where our kind can live?"

Desperately, his eyes searched that rugged green face which was the replica of his own. "We must find it, if there is! Because Lethara alone can be the mother of the new race. And because—we love her!"

His heart sank, then. He shuffled backward wearily.

For the giant had shaken his head. "There is no habitable world left in all this universe," rang the deep voice. "Nor any living thing surviving, save myself."

Ron Goneen's body sagged heavily in the bulky armor. "Then we have failed at last?" he sighed. "There is no hope at all?"

"You will find no home in this universe," his nude, green likeness assured him. "But," the deep voice went on, "I admitted you here for a reason. You have something that I need. If you will listen, I wish to propose a fair exchange."

#### XIV.

RON GONEEN shuffled quickly forward. His narrowed eyes stared searchingly up at the gigantic green image of himself. Suddenly he caught his breath. "There is a way?" he whispered anxiously. "There is some haven for Lethara—a new home for the race of our children?"

The shaggy, greenish head nodded, in the abrupt, decisive manner characteristic of Ron himself. The deep voice boomed in the phones, "That is possible—although not a certainty—through the use of my greatest treasure. And I would gladly put it at your disposal, if you will perform a certain service for me."

Ron Goneen stepped back a little, his rugged face grim. "What is that?" he demanded. "How can we possibly aid you, when your powers are so immense?"

"I shall tell you," answered the green giant. And now Ron Goneen first noticed a rather disconcerting thing: that the green lips no longer moved as that supernal voice came through the phones!

"We'll give you anything you ask," Ron said. "If you need matter—our spare stores and instruments, even parts of the ship—"

"Matter is indeed precious to me," the great voice echoed in their helmets, "but I do not ask for that. I will tell you my request—but first you must know a little of myself."

The space captain moved forward a little, eagerly listening, as the mighty voice went on: "You may know me as Orthu. As you have guessed, I am the last survivor of my kind. The fathers of my race came into being in the youth of this universe. Like your own kind, they presently mastered space, spread from planet to planet and from galaxy to galaxy.

"Not without disaster and defeat, they at last attained a supremacy threatened only by the death of this universe itself. They became, as I am, beings almost eternal. They slowly acquired a voluntary control over molecular structure: that ability to dissolve into a gas, to flow like a liquid, to condense into any solid form, that you found so amazing in me.

"They evolved, at the same time, a means of direct contact with space. It is that which enables me to move myself and other objects without the use of any cumbersome appendages. It is that, also, which enables me to create the radio waves by which my thought is conveyed to you.

"A new sense came to them with that advance. I am aware of the world lines of objects and forces in space and time, without the interfering aid of any cumbersome organs of special sense. I fully and immediately perceive every atomic process in both your brains.

"I tell you this because I have ob-

served your own curiosity, and to point out the height to which my kind was once advanced. Their development of the art of living was equally great. In truth, such material achievements seem insignificant beside their latter intellectual triumphs.

"YET, for all their greatness, they never conquered time. Despite every effort at conservation, matter crumbled ceaselessly into energy, as the ages passed, and the energy was wasted through space.

"The life of a universe is long. All the suns had ceased to shine many ages before I came into being. Yet, by collecting matter and accelerating its disintegration, we were able to survive. My life has covered half the whole time span of this universe.

"At last, however, dwindling resources forced us to attempt the one last and most important task of the intelligent life of any universe, the one which you performed in your own prematurely: the reversal of entropy.

"This laboratory was constructed for that purpose, with our last resources. I was chosen to attempt this fatal but necessary task, and the last of my fellow beings, since their places were no more, passed on.

"And for ages beyond memory I have labored at this task. The outlines of the problem have been clear from the beginning. But there is an elemental difficulty that I have never mastered. That, but for sheer chance, I never could—"

"True!" whispered Seru Gyroc. His haggard white head nodded in his helmet. "The elimination of the infinity factor!" his thin voice quavered. "I realized that pure accident alone led me to the correct solution. The mathematics of chance assured me that if I failed to perform the experiment, no other mind in our universe would stumble upon the Omega Effect. That re-

alization, with my mistaken pride, was what led to the fatal blunder."

The green giant moved eagerly a little toward him—not walking, Ron Goneen observed, but floating a few inches above the curving silver floor.

"So you know it?" the deep voice boomed. "You can solve my problem—give me release from this task of bitter ages?"

"I can." But the little man's quaver warned him: "If you release the Omega Radiation here, this place will be very swiftly destroyed, and your own life."

"That is well," the deep tones reverberated. "For I am long since weary of my task, and weary of being."

Ron Goneen shuffled forward, objection written grimly on his rugged face. "We should be destroyed also," he said. "We should never find any haven in this universe. It would become as dead as our own."

"That would not be well," agreed Orthu. "For your race is yet young and has not yet achieved its full fruition. I should, therefore, gladly open the way for you into another universe—into one that is young, in which you may find a pleasant dwelling for the one of you who is ill."

"You will make the exchange?"

"We will," said Ron Goneen, promptly. "Only show us the way and give us time to escape, before you release the Omega Ray."

"Then it is done," said the deep voice. "If you will reveal the information—"

"Hadn't we better wait?" Seru's apprehensive eyes came to Ron Goneen. "We should have evidence of his good faith."

"We have evidence enough," said Ron Goneen. "Tell him."

A LITTLE UNWILLINGLY, the old man launched into an exposition of the Gyroc tensors, and the formulas, apparatus, and processes involved in setting up the Omega Effect. The green

giant listened for a time intently, then cut him off with a sudden gesture.

"That is enough," the deep voice said. "Your thought has covered all the problem. You are indeed fortunate, Seru Gyroc, to discover that secret so securely hidden by the laws of increasing entropy."

"Unfortunate!" breathed the old man. "It destroyed our universe—"

"Now," Ron Goneen broke in abruptly, "the way to that other universe—for Lethara is very ill!"

For answer, the being Orthu raised a mighty bare arm, as if to point toward the maze of silvered machines in the vast space beyond the passage. Ron Goneen looked after his arm, saw an object approaching.

It came flying, apparently unaided—Ron recalled what Orthu had told them of direct control of the warp of space—and settled to the curving argent floor, near their feet.

It was a curiously designed oval chest or coffer, very massive. It was made of some bluish metal, and had evidently once been covered with singularly patterned red-and-black enamel. It was worn, however, scarred and battered, as if by the impact of immemorial ages.

"That box is older than I am," said Orthu. "The treasure in it is older than my race."

A heavy, queer-looking lock snapped open, as if to the turn of an invisible key. The thick lid lifted, as if of itself, and Ron Goneen bent forward to peer into the chest. He groped in amazement for Seru's arm.

"Look!" he whispered. "Another crystal like the Jewel of Dawn!"

Breathless, he was trembling to a sudden incredulous awe. Could this be another, yet smaller universe? Already they had once come into the infinitely small—could it be possible to become as much smaller, again?

"It is possible," that always startling



voice filled his helmet again. "You must be aware of the relativity of size?"

"And we may enter it, to seek a haven?"

"You may."

"But wait!" quavered Seru, anxiously. "You said it was older than your race. May it not be dead also?"

"There is a relativity of time," boomed Orthu. "I have looked into it. It is such a universe as you seek."

"If it's young, and you had it all the time," the old man demanded suspiciously, "why didn't your race migrate to it? Why don't you go there yourself?"

"Your children will know the answer to that question," the solemn tones replied; "when your race is as old as mine! Now go, if you will, so that I may finish my ancient task, and also depart."

"Farewell, Orthu," said Ron Goneen. "And thank you." He shuffled back toward the *Life of Man*, and assisted Seru Gyroc into the entrance valve.

## XV.

BACK in the little bridge room, he started the Kardishon oscillator, and their second interuniversal voyage was begun. The walls of the cylindrical passage receded. Orthu, the doomed last survivor of a dead universe, expanded into a vast, dark cloud that still had the shape of a majestic, watching man.

The space captain lifted the dwindling vessel, guided it into the ancient chest, which still rested at the feet of the expanding giant. They glided down toward the second jewel: a growing bubble of shimmering white, lying on something like black velvet.

The chest became a monstrous chamber, filled with increasing gloom. The supernal statuesque figure above was lost in darkness. Presently only the silvery sphere was left, growing always, drawing away.

Leaving Seru at the controls, Ron went back to Lethara's cabin.

Her pale body didn't move when he entered. But her faint voice called. "Come to me, Ron. I need you now, my dear—and I shall not need you long."

He came and took her hand. "Don't think of giving up, my darling," he whispered. "We are flying now into a new, younger universe. We will find some friendly planet there—a home for you and our children."

Her white head shook very slightly.

"I don't need a home, Ron," she breathed. "No home but your heart. And we shall have no children." Her great dark eyes were on his face, serene, unafraid. "The dream came again while you were gone. It was the same. I know I am going to die!"

His fingers tightened desperately on her hand. "But you can't die—you mustn't!"

Her huge eyes were suddenly shadowed with remembered horror. "Those things of cold black fire, on the rocks of Pyralonne—they drank away my life. This with you, Ron, is only a pale ghost in my body, soon to perish also." Her tragic eyes closed. "I am very sorry," she breathed faintly. "Because—because I love you, Ron!"

Her white body lay very still. He could barely detect the motion of her breathing, the slow throb of the pulse in her wrist. He still sat beside her, fighting a deadly and ultimate fear, when he felt a sudden, disquieting lurch of the vessel.

"RON!" quavered Seru's voice from the speaker. "Come! For we are through—and there are stars!"

The sleeping girl seemed undisturbed by that abrupt, giddy plunge from universe to universe. He left her, hurried to the bridge.

Seru Gyroc stood weary and haggard over the controls. "The reflecting bar-

rier yielded as before," he reported, "until the field effect rotated us into the fourth axis."

Peering eagerly into the dark space without, Ron Goneen saw a long spiral of silver dust, splendid with innumerable many-colored points of diamond light that burned through green streamers of nebulae.

"There!" His cry was a deep sob of joy. "There is a galaxy—one like our own that was destroyed! There are suns in it. There must be planets—a place for Lethara—"

The old man nodded gravely. "Yes, a home for my daughter," he said. "For your children, and the new race to come. Orthu played fair."

"It is strange," Ron Goneen whispered suddenly, "to think that we are now so infinitely small—that all this universe must be smaller than the smallest particle of our old one!"

"But is it?" questioned Seru. "We have spent none of our mass. Remember the relativity of—"

Ron Goneen had ceased to listen. His rugged, red-bearded face was suddenly grim with agony. In a choked, apprehensive voice, he sobbed, "Lethara! She called me—"

There had been no sound. He could not define the manner of his impression. But dread was cold in his heart as he ran back to her small cabin.

"My darling, I am here—"

The words stuck in his parched throat. He walked slowly toward her bed, looked down. She lay still. Her eyes were closed. A quiet, strangely peaceful smile touched the corners of her lips.

Gently, almost reverently, he picked up her cool, lax hand. But already he knew that she was dead.

## XVI.

LETHARA IS DEAD! Again and again the words throbbed through Ron

Goneen's numbed, stricken mind, like hammers of leaden pain. Lethara was dead—and with her his heart—and the race of man.

He gently folded the cold, small hands on her breast, and covered her face. Kneeling beside the bunk, he thought aimlessly of the grim, strange life the girl had led since her birth in their exile on dark Pyralonne, of her shattered chance for happiness.

He stayed there until Seru called from the bridge: "Come, Ron! Quickly!"

Purpose and vitality had died in Ron Goneen. A dull automaton, his big body rose stiffly and reeled mechanically forward.

The emaciated little scientist was tinkering excitedly with the vessel's long-range hyperchron receiver. His thin hand jerked tremblingly toward the telescope.

"Look!" he cried. "At the suns in that galaxy!"

"But it doesn't matter, Seru," Ron told him wearily. "It's no use now. Nothing is any use!" His tanned hand dropped sympathetically on the old man's shoulder. "Because, Seru—" He gulped. "Because Lethara is dead."

But Seru Gyroc's bright-eyed excitement was not affected by that statement. Heedlessly, he pushed Ron's hand away, went on with his feverish efforts to tune the hyperchronoscope. Thinking dully that this greatest mind must at last have cracked under the awful pressure of cosmic disaster, Ron caught the shoulders of the old scientist, swung him away from the instrument.

"Don't you understand, Seru?" his grave voice said. "I told you that your daughter is dead."

The old man struggled desperately. "But she isn't!" his cracked voice sobbed wildly. "Not yet! Let me go, Ron!" He twisted free, sprang back to the receiver. "Look in the telescope!"

he begged. "Go ahead—look! I'm not insane!"

The space captain staggered heavily at last to the little instrument, put his lusterless, bloodshot eyes to the oculars, scanned the luminous whirlpool of that distant island universe.

And all his grief and apathy were suddenly gone!

"What is it, Seru?" His voice was deep and tense again, electric. "What did you see? Why does that galaxy look so much like our own?"

The old man's voice jerked brokenly from where he bent over the receiver.

"Remember the relativity of size? Magnitude, like space and time, is cyclical. We have completed the cycle of change, and come back to our starting point.

"Yes, that galaxy is our own!"

"But our universe is destroyed!" rumbled the bewildered objection of Ron Goneen. "Our galaxy perished with the rest. We saw it!"

"But remember," the old man mumbled, still busy with the dials, "the direction of entropy is the arrow of time. When the Omega Effect reversed the current, we were flung backward——"

THE HUM of a carrier way came suddenly from the hyperchron receiver, then a snatch of military music. The once-familiar features of a newscaster appeared on the rectangular screen.

His brisk voice barked: "Hello, universe! I bring you the latest hyperchron dispatch from the Goneen-Gyroc Expedition, on the far-off planet Pyralonne. After two hundred years of work in exile, Seru Gyroc is about to make the crucial test in his great Omega Ray experiment.

"Success will open the door to a new age of wonder. Mastery of entropy, Gyroc believes, will make anything possible—even to cooking on ice!

"But if it fails?"

"Well, two centuries ago, in a speech

before the Galactic Council, Captain General Ron Goneen made some dire hints of cosmic disaster. That same day, he joined the expedition!

"Listen to-morrow, universe, for the latest——"

The old man's trembling fingers spun a dial; voice and image faded. "That proves it!" he cried. "We are back in our own universe, a few hours—or perhaps only a few minutes—before the moment of our fatal experiment!"

Ron Goneen's deep-set blue eyes were staring at him in anxious bewilderment. "Then they—we—are all still alive on Pyralonne?" he gasped. "Even *she* is still alive—Lethara? Our experiment has done no harm?"

"Not yet," said Seru, gravely. "But it is about to be performed. You heard the announcer!" A strange, fanatic elation of despair burned in his bloodshot eyes. "We have returned to witness the doom that we wrought! And to perish, fittingly, by our own act! For the jewel is left behind. There is now no way to any other universe!"

The space captain's rugged face was suddenly stern with purpose, his blue eyes narrowed and grim. Low and hard, his quick voice rapped: "Then we must stop our own experiment! How far is it to Pyralonne? The charts——"

"Only a few light years, probably," said the terrible-eyed oldster, "since, according to the principles of inter-continua dynamics, we tended to return to the point we left. But the experiment cannot be stopped!"

"It must be!" Ron Goneen was already over the controls. "To save the universe!"

The old man shook his haggard head. "Impossible!" he shrielled. "The chain of events is now inevitable—for the experiment resulted in our being here. Logically, a result can never change a cause!"

Ron Goneen's narrowed eyes scanned

the charts, while his long-practiced fingers set up their position on the automatic control board.

"I think," his deep voice said gravely as he worked, "that the direction of entropy increase is the only objective distinction between causes and effects. And we have reversed entropy——"

He moved swiftly to the telescope. "There it is—cold, dark Pyralonne!" he whispered. "We shall see if there is time——"

THE soft humming of the generators rose again to a painful, ceaseless screaming, as the *Life of Man* flashed into that last desperate race through the void. Wearily pacing the tiny floor, Seru Gyroc clutched suddenly at Ron's green tunic.

"If it should be possible," he gasped, "to undo my crimes! To save my daughter, and Karanora! To spare mankind——"

He was interrupted by the clanging of a detector gong.

Still tense at the telescope, Ron Goneen distinguished a familiar pattern of red-and-green lights drifting far away, athwart the faint, flattened spiral of the Andromeda Galaxy.

"The *Silver Bird*!" he whispered hoarsely. "Already it is standing away from Pyralonne. The two of—of us—are now alone in the tower—about to begin the experiment. Time is short!"

"Yes," quavered old Seru, "our time is short. This time we are to be destroyed, by our work, forever. That is cosmic justice——"

Ron Goneen was standing rigid at the controls. His great body, wet with sweat, gleamed like a statue of bronze. His narrowed eyes peered resolutely ahead.

"Pyralonne!" he whispered again, hoarsely. "The only world Lethara ever knew—— There's the tower, the landing lights!"

His eyes probed the eternal darkness

that lay upon that cragged, frozen plateau. He could make out the squat bulk of the laboratory tower, faint gleams filtering from its shuttered ports.

It was strange—maddening!—to know that he and Seru were *there* in the dark tower, setting in motion a force that would destroy the universe, yet also *here*, racing desperately to avert that doom.

His intent eyes were watching the tiny stars of red and green that outlined the rectangle where the *Silver Bird* had rested. They went suddenly dim.

"The lights——" It was a sob of agony. "The current drain, when the apparatus started! They—we are just beginning! There is no time——" The old man shook his tangled, hoary head. "I told you we must fail—must perish for my cosmic crime! For logic allows nothing else——"

"No!" The space captain's voice was a rumbling drum. "We can't fail!" His quick fingers flung the little ship into a dive; tortured generators shrieked again. "I'm going to ram the tower!"

"You can't!" shrieked Seru. "For if you destroy us then, we can't exist now, to do it——"

But the cruel plateau of frozen crags, the squat night-shrouded bulk of the tower, were rushing upward. Still steady, Ron Goneen's long, bronzed fingers moved to aim the ship accurately at the flat dome. His big body braced itself for the impact. Calmly, in that last mad moment, his deep voice was saying: "When the law of entropy has been overturned, there is no *then*, no *now*——"

## XVII.

RON GONEEN was dreaming again. It *had* to be a dream he knew. It *couldn't* be real! It was strange enough even that he dreamed, it came to him; for he had expected to perish in the ramming ship.

But it was a very satisfactory dream,



he felt—even if all his body up to his eyes seemed to be wrapped in bandages, and his first effort to move brought a series of dull, vague pains.

It was becoming curiously real and persistent for a dream, of course. And yet it *must* be! For he had seen Lethara dead, had folded her cold hands and covered her pallid face.

Now, however, she was sitting beside his bed, and smiling down at him. And she looked radiantly well—as utterly beautiful as she had been before the fateful experiment. The glory of her hair was no longer white, but golden again. Her oval face was serenely young. Her violet eyes no longer held any horror, but only sympathy, concern for him, a bright hope.

"Ron?" her soft voice was asking. It was thrillingly familiar, thrillingly real—alive! "Can you hear me? Can you see me? Is it too painful to speak?"

"No." The voice that came through his bandages was very weak and low. It set a sudden dull aching in his strapped chest, that, so experience told him, meant a few cracked ribs. "Where—am I?" he whispered. "Is this—no dream?"

"No dream at all," the huskily sweet voice of Lethara assured him. "You are in the hospital of the *Silver Bird*. And don't worry!" She touched his bandaged shoulder, very softly. "You're going to be all right, Ron, dear—and so is father."

"But what—happened?" he breathed the painful words. "You are—alive?"

"Of course I am, darling," she said. "But it's just luck that you are!" Great and dark, her violet eyes were suddenly glistening. "I was so afraid—" She bit her full trembling lip, swallowed. "Anyhow, you're going to get well!" She was smiling gloriously through the tears.

"But I think," she added, "that the great experiment is ruined."

Ron Goneen took a cautious breath

and whispered two words: "What—happened?"

Her cool, soothing hand touched the little bare streak of his brow, very gently. "Don't talk any more—it hurts you too much. Just keep quiet, and I'll tell you. Of course you and father didn't have time to realize what hit you—"

"What!"

"Quiet!" she commanded. "I promised not to disturb you."

He liked the soft stroking of her fingers on his forehead. He waited obediently.

"We were standing off into space to wait for the experiment," she told him. "But suddenly our detectors revealed a large meteoric object—and showed that it was hurtling toward the tower!"

"We raced back in the *Silver Bird*, to try to deflect it and save you. But we were one minute too late. The thing—whatever it was—struck the laboratory, shattered it!" Her great eyes were briefly solemn and disturbed.

"It seems very queer that a meteor should strike here, so far outside the galaxy, and just in time to stop the experiment! The officers have been talking about a conspiracy of nature to protect the law of entropy—" Her golden head shook; her eyes were again smiling.

"ANYHOW, we were in time to pick you and father up out of the wreckage. You were both pretty badly battered, and, of course, nearly asphyxiated. And something—queer—must have happened to father." Her voice was grave; puzzled dread shadowed her violet eyes.

"His hair has turned white," she said. "And he seems suddenly so very old!"

"I know." Ron Goneen caught his breath, made the effort to speak again. "No other—bodies?"

The girl stared at him, questioningly. "Of course not. How could there be?"

"You and father were alone in the tower." She bit her full lip absently, and added in a puzzled voice: "It was a queer thing, though, that we couldn't find an atom of that meteor!"

"It went through the floor beneath the dome, to the life tube in the safety chamber. The little ship was completely wrecked. We found you and father near it. But there wasn't a trace of the meteor left."

Ron Goneen shut his eyes and tried to think. Entropy. Reversal of time. Annihilation of cause and effect. Three who had lived twice—and returned to destroy themselves. Where were the missing bodies? His head began to ache a little. Lethara's hand was very comforting on his forehead.

"Oh, yes—Ron!" the girl's soft voice came to him suddenly. "Father sent you a message. I don't know about it. You might want to hear. He seems a little—well, out of his head. Mother is with him now."

Ron breathed, "Message?"

"Wait," she said, "and I'll tell you the exact words." Her smooth brow wrinkled with effort, as she repeated slowly: "The closing of our world lines in space and time, when the cycle was completed, created an independent

subspace manifold which is therefore detached from our continuum. What happened to us is real in that new subspace, but not in this universe."

"That's it," she said, "if it means anything!"

"It does——" he gasped. "Everything!"

"Somehow, father has changed his mind about the experiment," she said. "He told the men not to try to save any of the apparatus. He's giving it up."

Her dark eyes looked at him suddenly, regretful. "There's another thing—that I know you'll be sorry about," she said. "The stone from Andromeda—the Jewel of Dawn—was gone from the pouch in your tunic. I asked the men to search, but they couldn't find it anywhere."

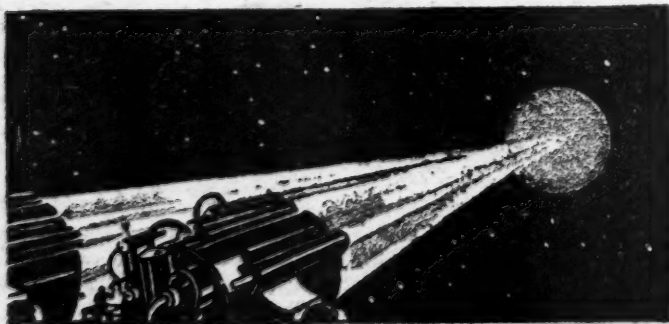
"Doesn't—matter!" breathed the space captain. "This universe—good enough—now." He took a careful breath. "Because—of you—my darling!"

"Don't talk," she commanded.

And Ron Goneen, captain general of the Galactic Patrol, he who had taken the Jewel of Dawn from the warrior crystals of Andromeda, obediently closed his eyes.

Her lips were cool against his forehead.

THE END.





## AN OPEN FORUM OF CONTROVERSIAL OPINION

### The Origin of Legends.

Dear Mr. Tremaine:

May I be allowed a few more words on Atlantis? (That "few" may turn out to be a euphemism.) First, I note that Mr. White considers New Yorkers opinionated. I infer (perhaps wrongly) that by "New Yorkers" he means inhabitants of the city, not merely the State. Well, I'm sorry he doesn't like us city slickers. But may I suggest that he be a shade more careful in using terms? You see, Miller lives away up near Schenectady, which makes him a kind of Yankee. And Clark is a native of Alaska, who has lived in various parts of the country. Just what is a New Yorker, Mr. White?

But to get down to Atlantis: What does Mr. White want—entertainment, or a knowledge of the facts? The scientific method seems to work, whereas other methods that have been tried for a much longer time very certainly don't.

The scientific method is roughly as follows: You wish to learn hitherto unknown facts about something. Very well, first you study all the facts that are known. Then, by the strictest logic you know, you draw inferences from these facts. You may find that you can draw several mutually exclusive inferences from one set of facts; obviously, they can't all be right; maybe none of them is. These inferences you call "theories." Finally, and most importantly, you check your theories by observation and experiment; by experiment wherever possible, to see which, if any of them, stands the gaff. There's more to it, but that'll give you an idea. All three steps are absolutely necessary if you want to be scientific.

Mr. White may have taken the first two, at least partially; I venture to doubt whether he has taken the third. Plato never even took the first; instead of facts, he started with assumptions that seemed to him necessarily true (not the same thing). And the idea of verifying any of his theories seems never to have occurred to him.

Moreover, because your theory works a few times, you aren't justified in assuming that it will always work, or even that it's correct at all, except over the range of observations that

you've actually made, within the limits of error of your instruments, and under the conditions surrounding those observations. The fact that a theory is consistent with certain facts doesn't say that the theory is true. To "explain" some historical or archeological problem by assuming that this, that, and the other took place proves absolutely nothing about what actually happened. To jump to the conclusion that a set of assumptions is correct, merely because they're not obviously contradicted by known facts, may be a swell method of plotting a science-fiction story; it may even be good philosophy or mysticism; but it is not science, and don't let anybody tell you it is.

Why? Just look at all the wrecks of beautiful theories that at one time or another were believed to explain the facts as then known. Take, for example, the epicyclic theory (to account for apparent planetary motion), the phlogiston theory (heat of combustion), and Cuvier's theory of recurrent catastrophes (fossils), or even one of the most brilliant and successful theories of all time—Newton's law of gravitation. All worked—for a while—until we got more facts and more accurate observations.

Then are theories useless? No. We use them to help us hunt up more facts, like using a flashlight in a dark cellar. But that doesn't say that they're true in any final or absolute sense. We expect, sooner or later, to find facts that don't fit them. Then, if they're patchable, we patch them; if not, we throw them away and get better ones. That's science. Now, Mr. White, try the scientific method on your Atlantean warship with cannon and a searchlight, and on all the other sublime speculations about lost continents. That is, if you want to. If people insist on believing things in the absence of good evidence, that's their lookout. But please don't call those beliefs science. (See Bell, "The Search for Truth.")

The same objections apply to the "Why not?" argument, which has popped up in the letters, in Mr. Jensen's among them. Why couldn't the pre-Inca Peruvians have known metallurgy? No reason; but where's the evidence that they did? For that matter, why couldn't they have descended from a preloard of Malays blown from

Sumatra across the Pacific? Why couldn't they have descended from South American howler monkeys? Not that I think they did; I'm just showing you where the use of untrammelled speculation instead of the scientific method, lands you. However, the speculations of trained scientists sometimes seem to check with the facts as later discovered; those of professional windbags like Plato, almost never.

Let's take a look at the old boy. We can suppose that the "Dialogues" were: (a) stenographic reports of conversations among Socrates and his friends; (b) a rehearsal, more or less in Plato's own words, of such conversations; (c) pure fabrications to illustrate Plato's philosophical ideas. The Plato scholars seem to favor (c), with faint traces of (b) here and there. They rule out (a) completely. If the "Timæus" and "Critias" belong in class (c), Atlantean inferences therefrom would seem as silly as argument about the reality of the countries in "Gulliver's Travels."

But suppose—to make a very large assumption—that we provisionally accept hypothesis (b) for these two books, and assume that the *Critias* of the "Dialogues" is the real *Critias*, and that he actually did spin such a yarn. Plato makes *Critias* say that he got the story from his grandfather, who got it from his father, who got it from *Solon*, who got it from an Egyptian priest. The real *Critias* seems to have been a talented rascal, but a scoundrel none the less. Are we to assume that on this one occasion he spoke the unvarnished truth, contrary to his usual custom? About *Critias'* grandfather and great-grandfather we know nothing. Were they conscientious and literal-minded seekers after facts, or were they tellers of tall tales? How can we assume either? *Solon* is supposed to have been an honest man, but our information about him is somewhat vague and contradictory. And anybody who would take the unsupported word of an Egyptian priest in this age needs a guardian. Not that they weren't clever let—witness their record of hornswoggling the Egyptian people over several millennia—but that's not quite the same thing as being honest.

Is there any reason why Plato couldn't have made the story up? No; that theory is at least as consistent with the facts as the idea that he got the tale from some one else. Readers of the "Timæus" and "Critias" will, I fear, be disappointed. There are no airplanes or automobiles; nothing, in fact, that the glibby old gentleman couldn't have thought up out of his own head without half trying. He does mention a metal (forget the name; something like "chrysanthemum") that the Atlanteans are alleged to have had, but all he tells us of its properties is that it was red. They had lots of crimes (just as Plato's Athens had), and a rigidly schematized organization which looks suspiciously like the ideal state described in Plato's "Republic." I'm not using the "Why not?" argument, and implying that, because of the foregoing facts, Plato must have invented Atlantis; I'm merely suggesting that there's nothing inherently unreasonable about the idea.

How reliable are legends generally? The idea that each legend has its "kernel of truth" (to quote Mr. White) is an attractive and superficially plausible one. But, alas, it appears to have gone to pieces—like a lot of nice theories—under intensive modern investigation.

Take the sad case of *Robin Hood*. He was supposed to have been a Saxon outlaw who fought the Normans. But none of the names of the alleged robber band is Saxon; most of them, including *Robin's*, are Norman French. (The names beginning with "Eg" were Saxon.) He was an expert with the long bow fifty or seventy-five years before the long bow came into use, and despite the fact that the Saxons were on the whole notoriously poor archers. One of his companions was *Friar Tuck*—half a century before the first friars landed in England. *Robin* was made Earl of Huntingdon by *Richard I*—though we know perfectly well who the Earl was during *Richard's* time, and he wasn't *Robin*. By the time all the improbabilities and absurd-

ties have been deleted from the legend, there's not much left.

Then where did these stories come from? When we examine pre-Christian European myths generally, all becomes clear. *Robin* is our old friend the god of sowing, or of soil fertility, tricked up in late thirteenth-century clothes as the priests never notice him. And so it goes with the others.

King Arthur, debunked, shows a suspicious resemblance to the old Brythonic war god. Sad, but that's the way the evidence points. Instead of becoming more historically credible as we go farther back, the legends become mythier and mythier. Compare the "Niebeungen Lied" (which drags in *Attila* and credits him with deeds that *Attila* certainly never did) with the older and much more fabulous "Völsunga Saga." (Wagner synthesized them and added some mythology of his own for the "Ring" operas.) (To see how these things start, see Fraser, "The Golden Bough.")

A modern expert mythologist, Lord Raglan, in discussing the Irish *Cuchulainn* (the rough guy among legendary heroes) says: "The first (view) is that *Cuchulainn* was a real man whose exploits have been exaggerated by tradition. According to this view, you have merely to pick out such incidents as appeal to you, and you have history. As a fact, however, there is nothing in *Cuchulainn's* story that suggests that he was a real man, and it is now common to realize that you cannot turn fairy tales into history by leaving out the fairies." (Raglan, "The Hero.")

Why not? Were the authors of the "Eddas," the "Illiad," the "Panchatantra," and the "Dialogues" skeptical modern historians writing for students? They were not. They were priests writing for the faithful; philosophers expounding moral ideas; poets entertaining their employers and customers. Their objectives were not to record what actually happened—even if they had known—but to gain converts, guide the young, prove their moral contentions, amuse and astonish. They wrote not what happened, but what they thought ought to have happened. What's remarkable about that? Didn't an American clergyman admit, in the early 1800's, that he had made up the Washington's-cherry-tree story out of whole cloth? (See Beard, "The Discussion of Human Affairs," and Croce, "The Theory and Practice of History.") Further, the ancient writers were by modern standards unbelievably credulous. You could make them believe almost anything you chose to tell them, provided you started by looking mysterious and saying, "Come hither, my son, and I will confide unto you the dread secrets of the ages."

When we get back to barbarous and savage peoples, all trace of anything that we call history disappears in an amorphous fog of legend and ritual. A modern anthropologist, in describing the Comanche Indians, says, "This practicality may be related to their almost complete indifference to the remote past. Although there is historical evidence that they did not reach their present territory much before 1700, they have no migration stories. Conversely, they have no idea of having been created on the spot. In fact, the only creation myth collected is probably of Christian origin. Even recent historical events seem to be forgotten as soon as the last individual who participated in them dies." (Linton, "The Study of Man.")

One more word, this time about the origin of names. Mr. Thompson speaks of the "first five letters" of the Mayan word *Atlan*. But the Mayans had no letters; they wrote in ideographs. Even if the word was something like *Atlan* in one period, it was very likely something unrecognizably different five hundred years earlier. English people five hundred years ago pronounced "time" the way we say "team," and "mouse" the way we say "moose." (Moore, "Historical Outlines of English Phonology and Morphology.") English has a noun *squash*, meaning "vegetable," and a verb *squash*, meaning to crush. You might suppose these to have a common origin. But the noun is believed to



be from the vulgar Latin *esquassore*. So much for *Atten*.

Yours for more science-fiction and less fiction in science.—L. Sprague de Camp, 810 Green Ridge St., Scranton, Penna.

### Re: Planet 5.

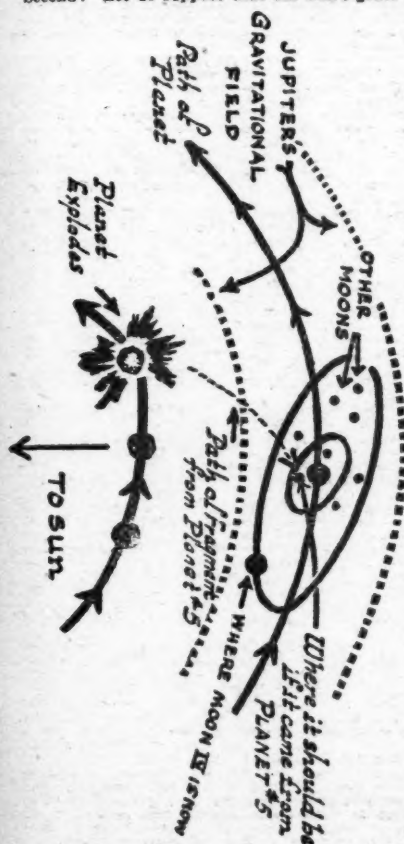
Dear Editor:

Until this month I have remained as one of your great majority of readers, silent. It was only to-day, after reading a letter printed in *Science Discussions*, that I decided to write to you and start another argument.

The letter referred to is that written by Mr. Parsons, in which he described his theory about the irregular motion of Satellite IX of Jupiter. I have studied this diagram and his theory and have come to the conclusion that there is something definitely wrong with both. This is what I have found:

First: Since the mythical Planet 5 was a considerable distance away from Jupiter—even though it was a little ahead of it on its course around the Sun—by the time it was anywhere near Jupiter's gravitational field the great planet would have changed its position so much that the fragment of Planet 5 would either fall directly into Jupiter or pass way off to one side.

Second: Let us suppose that the Sun's gravi-



tation did not act on the fragment. If not, the gravitation of Jupiter would have enough power to attract it to itself. But, because it is so powerful, what would prevent the fragment from taking a sharper curve toward Jupiter? If it did, it would come closer to the planet's surface than it is now, and there it would be acted on by the gravitation of the other satellites of Jupiter, which would set it into motion in their natural direction, provided it did not fall into the planet itself—saving many headaches for astronomers and people like Mr. Parsons.—Max Bernson, 1678 Bathgate Ave., New York, N. Y.

### Explanation Wanted.

Dear Sir:

I have a question to ask of you or any reader who can answer it for me. Perhaps I should say that this is more in the form of a solution to an experiment.

To-night, in the laboratory, I was measuring the specific gravity of various liquids, with a hydrometer. All at once I happened to look in the jar of alcohol, upon which I was performing the measurement, and to my surprise noticed that the hydrometer had apparently disappeared. Upon closer inspection I found that it had not actually vanished, but had, in some strange way, become invisible! I tried the odd experiment over and over again, in all types of light and found that in all cases, except where I used red light, the tube (hydrometer) remained almost totally invisible.

Is there anybody who can account for this phenomenon? By an accounting, I mean an accurate and lucid explanation and not a theorizing or answer such as, "It was the light rays being bent—etc., etc."

I am aware that an almost parallel feat has been accomplished by magicians on the stage (by means of mirrors at right angles to one another), but what I would like is a proven, simple, explanation.—Gerry A. Turner, 225 Central Park West, New York, N. Y.

### Gravity Acceleration.

Dear Sir:

I have noticed that some of your readers object to "great leaps of one hundred feet or more" by heroes on the small astral bodies, voicing as their objection the belief that at the end of such a leap the hero would be dashed to death by the force of his impact with the surface of the object.

Apparently these objectors have failed to take account of the difference in the acceleration of gravity which permits such prodigious leaps. Consider, for instance, an object whose gravity acceleration is eight feet per second compared with Earth's thirty-two feet. On earth an object falling one hundred feet will attain a velocity of only eighty feet per second, while on the body mentioned it will attain a velocity of only forty feet per second, equivalent to falling from a height of twenty-five feet on Earth. However, even on such a body a man will not be able to leap more than four times his normal leap on Earth, or more than about twelve feet, considering that the whole body is lifted to that height. On a body with a gravity one tenth that of Earth, he will be able to leap perhaps thirty feet above the surface, and will still land with no harder thump than if he had jumped from a desk top to the floor, on Earth.

"Escape velocity" seems to be having considerable attention. Do the mathematicians forget that as long as a rocket is able to push itself away from the Earth an escape velocity is not necessary? If it can carry sufficient fuel, it can push itself past the point where the Earth's and Moon's attractions are equal and then fall to the Moon's surface without ever attaining more than a small part of the theoretical escape velocity.—Delancey O. Martin, Key West, Florida.

### More About Jumping.

Dear Mr. Tremaine:

I'd like to put in an oar on this jumping discussion. I believe that Schuyler Miller is in error in believing that man who could jump with an initial velocity of 20 feet per second on Earth could attain 19.7 feet per second on Jupiter.

Assuming Mr. X to weigh 150 lbs.; to reach a velocity of 20 feet per second would require an output of  $150 \times 20 = 3000$  ft. lbs. per second, which, divided by 550, gives 5.45—gravitational attraction. His mass is the same but his weight is now double, i.e. 300 lbs. He can still exert 5.45+h.p. or 3000 ft. lbs. per second, but that will only impart a velocity of 10 ft. per second to his new weight of 300 lbs. Consequently, he would only be able to jump  $\frac{1}{2}$  as high as he could on Earth. Or would it only be  $\frac{1}{4}$ ? Besides his weight being doubled, wouldn't the acceleration due to gravity be twice as great as on Earth? Help! Help! Isn't there a college physics professor in the audience? I think we need to be straightened out on this subject by some one who really knows what it's all about. I'm right with Schuyler Miller and Jack Williamson in thinking that science-fiction stories should have story value as well as science. After all, we are interested in the scientist as well as his science. And, most of us being ordinary people, we find it interesting to have some ordinary people in the story so we can wander hand-in-hand with them, so to speak, through the plot. Dean Mynrdori, Box 728, Holdenville, Oklahoma.

### Question.

Dear Mr. McCann:

I was much interested in your article *Stress-Fluid*. Why not figure the limit of superimposed weight Manhattan Island can stand without submerging?

I would expect to find the heaviest substances at the core—gold, lead, barium and thorium, rather than steel. Iron's atomic number is only 26. The elements are ideally arranged in concentric spheres according to specificity and disarranged only by mechanical agency.

Does not the stress of gravity pulling matter in wedge forms affect by friction a great augmentation of heat, so that the innermost matters must be fluid through being molten? The consequent expansion could account for volcanoes and the presence of heavy substance at the surface flung out.—C. B. Loomis, Manhattan Beach, California.

### Answer.

Dear Mr. Loomis:

In answer to your questions: It is impossible to calculate the load that Manhattan Island could bear without failure, because of the number of indeterminate factors involved. It would not submerge through the stress-fluid action, in any case, since it represents too tiny a surface, and, furthermore, is resting on a geological fault at present anyway. The failure would be a slippage, if anything, tending to move the island out under the water rather than downward.

The load the island can bear cannot be calculated without more exact knowledge of the extent of that fault, and its distance beneath the surface. Presumably, it is about  $\frac{1}{4}$  to  $\frac{1}{2}$  of a mile down. At such a depth, so great is the superincumbent load and the resultant friction that, incomprehensibly, great loads would be required to start any movement. The loads imposed by tall buildings, anything within man's power, are entirely negligible. Further, the Empire State Building, probably the most massive, has its greatest cross section at the ground level, tapering to a tower as it rises. But it extends downward also, maintaining that greatest cross-section area into a cavity blasted into

solid granitic rock. The rock removed in constructing the sub-basements of such a building—in fact of all the large buildings of Manhattan—far outweighs the mass of the structure later erected. The construction of the Empire State Building, in other words, decreased the load on Manhattan Island.

The noble heavy metals, such as gold, platinum and the like, might remain in free, metallic state, but such heavy metals as silver, lead, barium and uranium would certainly be combined in the oxide-sulphide zone. The noble metals would not remain free, even in the metallic state, but would occur as dissolved metals in solid solution. The overwhelming quantities of nickel and iron in the metallic core would absorb them beyond recovery, probably even beyond detection. It is doubtful that separation could then occur. If the available oxygen and sulphur did not suffice to combine all metals, surely barium would still be combined; it is practically as voraciously active as sodium.

In the first stages of Earth's creation, before stability had been reached, there probably was considerable shrinkage and frictional heat resulting; but two billion years have passed since Earth was formed. In that time, it is probable that a completely stable equilibrium has been reached, ending the generation of heat through frictional action. The originally generated heat has, similarly, long since found equilibrium in such excellent heat conductors as the metallic core and the compact oxide-sulphide zone.—Arthur McCann, 761 Scotland Road, Orange, New Jersey.

### Wasting "Our" Air?

Dear Mr. Tremaine:

I am willing to eat my shoes on the fact that man will not use liquid oxygen and hydrogen for commercial fuels in the near future. It seems to me that the expenditure of 4,380 tons of fuel to go to the Moon and back is mighty wasteful on our air supply. The above figure is confirmed in P. F. Cretor's book, "Rockets Through Space." How long do you think our air supply is going to last at that rate? But that's only to the Moon. To go to Mars would require quite a bit more fuel. I don't think the Martians (if any) would care, though. Even with a rocket ship coming every week inside of a year there would be a perceptible rise in the oxygen content of their atmosphere. And soon they might be able to live on the surface, instead of finding a living in some deep underground city because of the almost all surface atmosphere. They probably got that way, too, by foolishly wasting their air on some fool planet 50,000,000 miles away.

It would be better to wait for atomic power (for it would do the job better and more economically) or even the almost impossible (?) Jules Verne's "Favorite," than to squander "our" wealth away. I don't think there is anything on any planet "dead or alive" that would call for the taking off of about a million years of Earth's life. You'd be surprised at the way figures mount.

But coming down to earth for a minute: Mr. Stone, the "sensation of repeated occurrences" has been the cause of much speculation among psychologists and has been named already as "memory of the present" by some people believing there is nothing behind it all.—Mark Reinsberg, 425 Surf Street, Chicago, Illinois.

### Attention, Mr. McCann.

Dear Mr. Tremaine:

In *Stress-Fluid* Mr. McCann has overlooked some facts of modern physics. As I wish to inform him about a few new discoveries, I am glad to take advantage of your excellent new department.

Mr. McCann is one of several writers who

overshoot modern knowledge. He says (Page 46): "That makes clear at once several important things." Then, after a long list of things, he says, "because no rock could possibly resist such pressure."

As well as nothing could stand the heat. Well, for one thing the earth would break up under cross-gravitational pulls—if the center was what he calls stress-fluid. Not only that, but there could be no tides, because the whole surface of the earth would stretch out, instead of just the water. And for the scientific standpoint, it has been found that when great pressure is brought to bear on a liquid, it returns to the solid form.

From the standpoint of the laboratory, Mr. McCann's reasoning is clear. But then no conditions at the surface are duplicated in the subterranean laboratory we call the interior of the earth. Mr. McCann has outlined a plan of perfect balance for our earth that is more nearly incredible than your stories.—Robert Barclay, 309 Glenhill Avenue, Yonkers, New York.

### Floating vs. Tumbling.

Dear Sir:

I wish to reply to C. T. C. of St. Louis, who complains about this business of men floating groundward on small planets, instead of taking a decent tumble as he thinks they should. Can we imagine, he asks, a man from a planet 1,000 times as great as Earth coming to our world, leaping into the air and floating down unharmed?

Such a man would not float down. He would fall just as heavily as any other body; for, disregarding atmospheric friction, all bodies, whether they weigh an ounce or a ton, fall Earthward with a uniform acceleration of 32 ft. per second. This acceleration is dependent upon the force applied—viz., gravity.

But in the case of a 180 lb. Earthman who ties himself to a planet where he weighs, on a spring balance, only 25 pounds, we have another story. The disparity in these 2 figures indicates that the small world has a gravity only about 1/7th that of Earth, hence its acceleration of freely falling bodies would be proportionately smaller. If such acceleration is 8 ft. per second, for example, this man would indeed seem to float downward, difficult as this may be for us to imagine.

And if our hypothetical visitor from a world 1,000 times greater than Earth were also to practice high jumps on the little planetoid where the Earthman scales 25 pounds, even he would float downward with exactly the same acceleration as the Earthman. Of course, if he were to jump higher, he would strike at a greater speed, but the acceleration would be the same, because again acceleration depends entirely upon the applied force, namely, gravity. The 25 lb. specification made is useful in telling us that the planetoid has a gravity about 1/7th that of earth, but otherwise does not enter into the problem.—Harry Walton, 34-50 43rd Street, Long Island City, New York.

### Antonyms.

Dear Mr. Tremaine:

Many, many moons ago—six, to be exact—I attempted to clarify my stand on the matter of numbers beyond infinity. I didn't succeed very well. In fact, I didn't even succeed in clarifying it to myself. No less than 20 letters coming to me, both through Science Discussions and through personal correspondence, assured me of that. Therefore, permit me to try again.

I admit that there was an error in my statements. (Loud cries of "No!" "Impossible!") But the error wasn't ordinary mine. (Loud sighs of relief.) It was the error of the first person to use as antonyms the terms "infinity"

and "zero." Let us look at the dictionary. "Infinity" is: "the state of being immeasurable; unlimited extent of time, space, or quantity; an indefinitely great quantity." But it is not "all," the given antonym for zero. "All" is defined as: "the whole quantity of, as substance, duration, amount, etc."

Therefore, we must coin an antonym for infinity. I suggest "infinitesimality," which would mean: "the state of being immeasurably small; an indefinitely small quantity." *Not—see, see! Or isn't it?*—Elton Andrews, 349 St. John's Place, Brooklyn, New York.

### Re: Rockets.

Dear Editor:

It's impossible to express my appreciation, in words, for a section of a magazine where personal views and problems in general can be cussed or discussed, as the case may be.

To get to my favorite subject, the ways and means of accomplishing space travel. The investigations conducted by the "Rocketeers," i.e. Goddard, etc., with thermal rockets with the fuels and metals available, show that this type of propulsion, besides being extremely inefficient, is limited by the melting point of the metals used in the combustion chambers. A number seem to believe that atomic power will be available sometime in the future. Well and good, if something can be found that will retain it. Surely it can be no metal, for all metals and alloys seem to melt below 5000°C.

The inefficiencies of the thermal rocket are due to the low "exit" speeds and the enormous amount of heat taken with the exhaust. There seems to be only one way to eliminate these two bugaboos, and that is by mechanical rockets. True, the mechanical rocket is beset with certain difficulties, but they are not inherent qualities of the materials used. They seem to be more of a mechanical nature.

The class of rocket should be classified in 2 parts: centrifugal and electronic. The centrifugal imparts motion to the atoms or particles by the use of a wheel spinning at a high rate of speed. This type would, of course, be limited to the strength of the rotating wheel. Even at that a wheel one foot in diameter and turning at only 2 or 3 times the speeds obtained in centrifuges, would hurl particles at the speed of atoms in the explosion of H and O.

The electronic type entails the use of ionized atoms being attracted by an electromagnetic field. Here the "exit" velocity would only be limited to the strength of the magnetic field produced. Further, the number of fields could be increased considerably with no increase of difficulties.

Since either of the mechanical rockets would be powered by an internal combustion engine, I delved in the physics book and here are the results: I find that 1 lb. of gasoline and 3 pounds of oxygen (is that the correct ratio?) will develop enough power in a well-known automobile engine to accelerate a 3600 lb. object to the required escape velocity, 7 m/s, excluding, of course, friction. Could one ionize the atoms of the exhaust and hurl them by the power of the same motor at some 2500 m/s, that 4 pounds of fuel alone would give the aforementioned 3600 lb. body the required escape velocity.

The 2500 m/s sounds pretty impossible, but physicists have caused electrons weighing 1/2000 as much to increase their speeds to over 6 times that value. But even so, a 1 lb. body could be given the 7 m/s by 1 lb. of fuel, provided the ions were propelled to the same velocity as the electrons, in proportion to their weight.

The above figures may be wrong, for when me and a formula mix it up, the formula usually works me instead of me working it, but they're mine and I'll stick by them (stuck with them?) until proved wrong. What say you others that are interested in this line of work? I'd certainly like to find out if I'm right. Under the impression that I've already said too much, I'm signing off.—Carroll Auvil, Box 166, Mineral, Washington.

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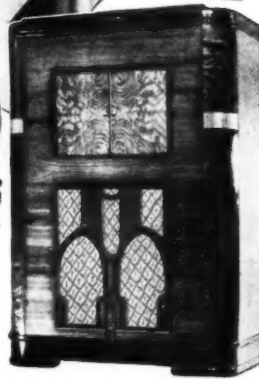
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